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# AN EXPERIMENTAL STUDY OF SLEEP*

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## CHAPTER VIII

### *Experiments on Cats*

IN passing now to my experiments on higher animals the results seem more striking and convincing. As in the case of the frogs, I can only quote some of the experiments performed, it would take up too much space of the present paper to quote all of them. Besides little will be gained by a literal transcription of my note-book, since many of the experiments are simply repetitions of one another. I shall bring as many facts before the reader as will sufficiently introduce him to the work and make him so familiar with the experiments performed that he may be enabled to follow closely the various threads that go to form the main strength of the present research.

A young kitten of about six weeks, very lively, runs about playfully, wide awake. When put on its back, it struggled violently. I then put the kitten in a cloth, kept it firmly so as to limit all the struggles and voluntary movements. At first it struggled and fought, but I restrained the kitten as much as possible, and then I closed its eyes for about a minute. The struggles ceased gradually and the kitten passed into a passive state of sleep. When I relaxed my grip on its body, it remained in the same position without moving a limb. At first the respirations went up and also

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the heart-beats. But as the kitten became more passive and went into deep sleep, the respirations and heart-beat fell. The kitten was deeply asleep, did not react to sound stimuli or to light; eyelids were firmly closed. At first a slight resistance in the outstretched paws, strongly suggestive of hypnotic catalepsy, was observed, soon the paws were fully relaxed and easily changed to any position, but without retention of impressed posture. The sleep lasted for more than twenty minutes and would have lasted longer, had it not been for the fact that I disturbed the kitten's repose to continue my experimental work.

The same experiments were repeated again and again under the same conditions of monotony, limitation of voluntary movements and inhibition. The results were uniformly the same. It may be well to call the reader's attention to the fact that holding the kitten down firmly, thus limiting its voluntary activity, is really at the same time conducive to greater monotony of peripheral sensations coming from the action and movements of the muscles, joints, synovial surfaces and so on; so that the factor of limitation largely aids the condition of greater monotony. Although the pressure exercised on the animal during restrictions may be intense, still, as we have pointed out, it is not so much the intensity of the sensory mass which keeps up the waking state, as the manifoldness and the volume of sensations and reactions ceaselessly varying from moment to moment as to quantity, quality and intensity.

The kitten was restricted in its movements; it was held down for some time, but it did not go easily into a quiet state. I found that the best arrangement was to enwrap the extremities, the hind extremities at least, in a cloth. This limited the voluntary movements effectually. It was still easier, when *all* the extremities were enwrapped in a cloth. When now I put my fingers over the kitten's eyes and closed them, there was little resistance and in a few seconds, not more than half a minute, the little thing was extremely quiet and in a minute or so it was fast asleep. The fingers were then removed, the kitten's eyes remained firmly shut. In fact, the eyelids resisted all efforts to open them. When forcibly opened, the eyeballs were found rolled up

and the pupils were contracted. The kitten would have probably kept on sleeping for some time, if judged by what had been observed in other kittens under similar conditions, had it not been disturbed in order to have the experiments repeated.

The kitten was snugly put away in a cloth, and all four extremities were restricted from voluntary movements. At first the kitten struggled a little, but was soon quieted. I then shielded the kitten's eyes with my hands, while I held it firmly for a few seconds only. The kitten's eyelids became half closed and finally closed fully. When the extremities were tested immediately, they were found resistive and slightly cataleptic. Occasionally the resistance was quite marked. The cataleptic state was rather transient. In some experiments I even succeeded in raising the paws into uncomfortable postures where they remained without change for a brief period of time. After a few seconds the catalepsy of the extremities passed off and the limbs were in a state of relaxation. The kitten did not react to stimuli, such as sound, light or smell; even slight pinching, change of the extremities, shifting of the posture of the body did not produce any reaction. When aroused from sleep, the kitten yawned and stretched its paws, looked sleepy and reacted sluggishly to external stimulations.

Kitten struggled hard when put on its back. It was enwrapped in cloth and still kept on its back, where it was held firmly without being allowed to turn over or even to move. I then closed the kitten's eyes. After a minute it remained in the same position. The kitten was lying quietly on its back, though the position was rather unusual and the whole attitude was very uncomfortable. The paws were raised in the air and at first there were manifestations of resistivity about the joints, but soon the resistivity passed off and the limbs, though raised, were really soft and relaxed. A little later the paws dropped slowly and remained in a state of relaxation. The catalepsy was replaced by lethargy. The kitten did not react to pressure or to tickling of the paws. When sounds were produced close to its ear, the ear moved, but otherwise, the posture of the kitten remained unchanged. Tickling of nostrils made it move its head, but the kitten remained in the same posture with eyes firmly shut.

The kitten was wrapped in its cloth as usual. At first the kitten was greatly excited and squealed. It was rather more difficult to make the kitten quiet than it was in previous experiments. The excitement was antagonistic to sleep. When finally quieted, which took some time, the result was even more successful than on previous occasions. The kitten was fast asleep. Before going into the sleep-state the same phenomenon of transient catalepsy and resistance was quite marked. The limbs then assumed a relaxed condition. It slept so soundly that stimuli that would have awakened the kitten on previous occasions did not disturb it at all, but simply called forth reflex reactions. The kitten slept for more than half an hour. It was then rudely awakened by me. The kitten was very sleepy and soon closed its eyes and sank once more into a deep sleep.

Three kittens eight days old. Eyes were open. Their movements were still incoördinate. They resisted, when put upon their backs. The kittens were wrapped in a cloth one by one. At first they struggled violently, but afterwards they became quiet and fell into a deep sleep. The limbs were in a state of relaxation. No manifestation of rigidity or of catalepsy could be observed while passing into or coming out of sleep. The induction of sleep took some time, but a few repetitions made the onset of sleep easier.

The kittens were wrapped in a cloth and their movements were restricted. After a little struggle and spitting they went to sleep. This time no symptoms of catalepsy could be observed. The kittens were probably too young to manifest any of these phenomena, for later the phenomena of catalepsy during the time of going into and coming out of sleep were, relatively speaking, quite marked. Closing the eyes did not play such an important rôle in young kittens as did the condition of limitation of voluntary movements. In this respect young kittens behave somewhat similar to young infants.

Kitten, two and one half weeks old; very lively. It struggled to get free. After three minutes the kitten was put to sleep; it was wrapped in a cloth and slept peacefully. On my attempt to open its eyes there was a little resistance, but not marked. On examination the eyeballs were not found rolled up, but they looked staring and

sleepy, and the pupils were contracted. The kitten closed its eyes immediately after and went to sleep again. There was little or no response to external stimulations of sound. In the next room much noise was made by a carpenter hammering with all his force. This was not favorable to sleep, but the kitten was deeply asleep and remained undisturbed. The kitten slept for fifteen minutes and was awakened by me for further experimentation.

The cloth has proved itself an excellent factor in putting the animals to sleep. This may be due to the fact that the movements are well limited without much pressure; the pressure present is more evenly distributed, hence, also more monotonous, a circumstance which greatly helps in bringing about sleep. The conditions must all coöperate to bring about *monotony*.

An attempt was made to put a kitten to sleep without the cloth. The animal was harder to handle, it took me some ten minutes before the kitten was made quiet. It fell asleep but for a brief period of time, possibly not more than a minute. Then it opened its eyes. Now for that short period the paws were found extended, somewhat resistive to but retentive of impressed movements. The paws trembled visibly. This tremor was due to the incoördination of the motor activity of the kitten.

I observed in my experiments on subjects and patients that *sudden* fright might bring about subwaking states and sometimes even hypnotic and somnambulistic states. Now when tested on kittens similar results were obtained. When the kitten happened to be specially refractory, it was frightened by sudden strong stimulations or by suddenly turning it around and around. To my great surprise I found that the kitten's struggles subsided,—the respiration became lowered and the kitten was asleep. As the experiments gave like results the few described will be sufficient for our purpose.

When one of the kittens was very excited and in a fighting mood, I seized it *suddenly*, kept it down firmly, the animal became very quiet, fell into a passive state and then was fast asleep.

Of three young kittens I seized one after another quite suddenly. The kittens became much excited. One after

another was put in a cloth, their limbs wrapped all round and kept down quite firmly, so that they could not move. There was but little opposition and still less fighting. By way of intensifying the effect they were given a couple of good shakings, the little ones became quiet, and fell into a sound sleep. They did not react to sensory stimuli; their paws were slightly resistive at first and then relaxed. Respiration, from being labored and quick, became quiet, uniform, easy and lowered.

These experiments were repeated by me over and over again and with the same results, showing that the latter were not a matter of accident. In fact I found that when I wanted to put the little kittens to sleep speedily, to frighten them by shaking was the surest way of putting them into a more agreeable mood and thus send them off without delay into a sound sleep.

In the experiments on the kittens we find the phenomena of the subwaking states somewhat more developed than in the guinea-pigs or in the frogs. The cataleptic phenomena are not so pronounced as they are in the frog, but the manifestations of the subwaking states approach more closely the manifestations observed by me in human subjects. The state is more hypnoidal in character, there is present the transient, scarcely perceptible catalepsy which appears for but a moment, giving way immediately either to sleep or to the waking state. Of course, we should not expect to meet with a typical, fully developed suggestibility or somnambulistic state in guinea-pigs or in kittens, considering the fact that even in man, the imbecile, the idiot and the mentally obtuse hardly go into any such state. It requires a mind of a highly organized constitution to get into a state of abnormal suggestibility and of somnambulism with their accompanying manifestations. What, however, we do find is the characteristic instability of the manifestations of the intermediary, subwaking, hypnoidal states, having some of the most general somatic symptoms of hypnosis, such as slight catalepsy, but leading into a passive condition on the intensification of the state. The state in which the animal is plunged under the condition of monotony and limitation is *hypnoidal* leading toward sleep.

## Chapter IX

### *Experiments on Dogs*

As we come nearer to the higher animals we find it easier to interpret the phenomena under observation and experimentation. The subwaking states become more defined and sleep is fully recognized at the first moment of its oncome. Thus in dogs we can more easily interpret the different motor activities in relation to their subjective correlatives and accompaniments. Man can so closely put himself into the subjective mood of the dog he knows that he can understand apparently the slightest expression of the animal's wishes and emotions. The artificial selection of the most intelligent and most devoted dogs as well as the constant companionship with the human race could not but affect the canine races and bring the most manifold expression of their emotions, wishes, and desires within the scope of human interpretation. Dogs have the mental touch of man and are described by the poet as dreaming in their sleep:

"Consueta domi catulorum blanda propago
Degere, sæpe levem ex oculis volucremque soporem
Discutere, et corpus de terra corripere instant,
Proinde quasi ignotas facies atque ora tuantur."

Lucretius describes vividly the active dreams of the hound hunting in his sleep:

"Venatumque canis in molli sæpe quiete
Jactant crura tamen sudito, vocesque repente
Mittunt, et crebras reducunt naribus auras,
Ut vestigia si teneant inventa ferarum:
Experge factique sequntur inania sæpe
Cervorum simulacra, fugæ quasi dedita cernant;
Donec discussis redeant erroribus ad se."

Dogs have some imagination, even if they are not poets, and cannot retort man in kind. Dogs, standing higher in the scale of development, lend themselves far better than the rest of lower animals for the study of sleep. As adult dogs are rather difficult to manage for sleep experiments, because

of the excitement in which they are thrown and because of their resistance to being handled by men other than their masters, I selected for my experiments young dogs, especially puppies. I did the same thing in the case of cats for the same reason, as grown-up cats are still more unmanageable than dogs. It is true, as Huebel has pointed out, that if the master of the dog should try his hand, he would no doubt succeed in putting the dog to sleep. Puppies are very docile, they get easily adapted to a new person and do not manifest the individual liking of their master and the abhorrence of strangers as grown-up dogs do. I have no doubt that if a grown-up dog should be put by his master under the conditions of *monotony, limitation and inhibition*, the success would almost be certain in each and every case. In fact, I tried the experiment on an older dog of mine with great success every time I put the dog under the requisite conditions conducive to the oncome of subwaking states and sleep. I shall give an account of these experiments in this research. I find that dogs, like men, easily fall into subwaking states and sleep.

There is also another reason why I chose puppies for my experiments. Puppies, especially very young ones, sleep a good deal and not having the nervous activity and distractions of older dogs are more amenable to the conditions of subwaking states and sleep. In carrying out experimental work it is best to select the material and put it under the most favorable conditions.

We may pass now to the experiments proper. I quote from my notes those experiments which are typical of the rest.

Two puppies of about two months old; very lively, excitable, and barking violently. After some struggle each one was wrapped in a cloth so that even the forepaws did not protrude. At first they were greatly excited by the proceeding and proclaimed their indignation by loud yelping. I took my turn with each one separately. The puppy was held down firmly and given no chance to move its body or to struggle with its paws. I also closed the puppy's eyes with my fingers. The puppy struggled and wriggled under my hand, but I held on tightly. Gradually the puppy ceased

its struggles and became very quiet. Respirations became slow and regular. I gradually released my grip on the dog, when I found that its eyes were firmly closed. The puppy was fast asleep. The same performance was carried out in the case of the other puppy. After five minutes, during which time I held the dog tightly and kept all the extremities in close grip, the puppy passed into a quiet state and fell asleep as the first one did. Respiration was slow and uniform. Both puppies slept peacefully. There was no response to external stimuli. Limbs were in a state of relaxation. In spite of the noise in the neighboring room the puppies kept on sleeping. After twenty minutes one of the puppies woke up, made some show of struggle, but the eyes remained shut and he fell asleep again. I tried to loosen the cloth in which the puppies lay enwrapped. My manipulations did not disturb their sleep The puppies kept on sleeping the sleep of the just. After a sleep of about an hour I had to disturb the repose of the little ones and wake them up, as I had to leave the laboratory, otherwise they might have slept much longer.

The cloth was now uniformly adopted by me in my experiments for the control of the voluntary movements. Unless the little ones were wrapped in the cloth there was great difficulty to restrict their activity. The puppies fought like furies. One of them was specially unmanageable. A few shakings quieted him. The puppy was wrapped in a cloth and after a few minutes went into a deep sleep. It withdrew the paws on irritation or on pinching, but the eyes remained firmly shut. Respiration and pulse were slow.

The puppies were put to sleep under the same conditions. This time they could not sleep soundly, on account of the continuous noise in the next room. They woke up every time, but fell asleep again. They growled in their sleep, evidently reacting to the external noises, but they did not wake up. One of the puppies turned on one side, apparently to make himself more comfortable and kept on sleeping. They were, however, to-day more restless than they were on former occasions. Maybe hunger gnawed at their entrails, maybe it was the noise of the school that the puppies could not stand. After about a quarter of an

hour they woke up and looked like two little surly pups. I gathered them once more up into the folds of my cloth, and gently, but firmly, forced them to sleep again. They went to sleep much more easily with no fighting. When passing into sleep, I tested the forepaws of each of the puppies. As this time the forepaws were quite free, I could observe well their position, change them, and manipulate them. At first the limbs showed some resistance to change of retained position impressed on them, a slight cataleptic state. Then the limbs relaxed and remained in this condition till the end of the experiment. This time the noise in the adjoining room ceased and the youngsters seemed no longer disturbed. I let them sleep for about three quarters of an hour, when I began to tickle them, pinch them slightly, and change the position of the paws. They began to move restlessly and gradually got out of sleep. The eyes opened lazily, and they evidently felt ready to go to sleep again. Before waking up fully there was a slight state of resistance in their forepaws, catalepsy seemed to return again. This slight catalepsy in regard to retained postures and to changes of the position of the extremities lasted a few seconds and disappeared. Thus in getting out of sleep the puppies passed once more through some subwaking state with its accompanying catalepsy.

The puppies were put to sleep again. The conditions of monotony and limitation were the same as before. Forepaws were free, protruding from the cloth. When the puppies sank into sleep, the paws were slightly resistive. The least disturbance brought the puppies out of the passive state. Typical manifestations of subwaking, hypnoidal state were present. Respiration gradually fell, the passive state became intensified, and the puppies fell into a sound sleep. The paws became fully relaxed. The eyelids were firmly shut and at first resisted pulling apart. When the eyelids were separated, the eyeballs were found rolled up; pupils were in state of contraction. When I let go the eyelids, they closed again and remained firmly shut. There was almost no response to external sensory stimulations. The puppies slept half an hour, when I began to waken them slowly, again before full waking a slight cata-

lepsy was observed in the limbs, the puppies passed through the intermediary, hypnoidal state. They looked sleepy when they opened their eyes and kept closing them. They stretched their little paws as after a good sleep and yawned.

One of the puppies was very irritable and surly; it fought like a little fury. It squealed, barked and yelped. After a little jostle in the cloth it fell asleep peacefully. Again a slight catalepsy of the limbs was observed for a brief period of a few seconds, then relaxation set in. The puppy slept very soundly; it did not react to stimuli of medium intensity. Reflexes of forepaws were present and when the stimuli became summated the paws changed position, the body then also tended to change its posture. The eyelids were firmly closed; when opened by force, the eyeballs were found rolled up and the pupils contracted.

The other little puppy was more amenable to treatment,—it did not resist, but seemed to be resigned to its fate. When wrapped in the cloth, it was very good natured. When I put my fingers on its eyelids and had them firmly shut, the puppy remained in the same position without fighting. Respiration was quiet, uniform, lowered. As the puppy sank into sleep the paws were found slightly resistive to bending; they were extended, but soon became relaxed and remained so throughout the sleep state. The puppy slept quite peacefully. Reflexes of forepaws were present. It did not react to slight stimulations, such as tickling or pinching of the skin, or even to pricking of the forepaws. It did not react by shifting the body or by waking up and opening the eyes, it only moved the forepaw that had been stimulated. The eyelids were firmly shut and resisted opening. When opened by force, the eyeballs were found rolled up, so that the whites or the sclera could be well seen partly covered by nictitating membrane. The dog was awakened by summation of slight stimulations.

Three new puppies were very tractable. They fell asleep with the greatest ease imaginable. The puppies were about two and a half weeks old, were quite gentle and showed almost no resistance. The same phenomena were present as in the other dogs; they went to sleep under the

same conditions, their paws for a brief period of a few seconds were extended and slightly resistive. Limbs retained the position given to them. The eyelids were firmly shut and there was resistance to attempts to force them open. When forced open, the eyeballs were rolled up, and the eyelids closed as soon as they were let go. The puppies seemed to possess the power of sleeping indefinitely. Now and then sucking and snapping movements were observed. They slept for more than an hour and would have gone on sleeping had not they been rudely shaken out of their peaceful repose.

The experiments were repeated over again with the same results. As the puppies got older the manifestations of the transient, intermediate state became more pronounced,—catalepsy was more evident on falling asleep. The same held true in the case of waking up. There was a slight stiffness and catalepsy of the paws for a brief period when the puppy emerged from sleep. On falling asleep the puppies did not tumble at once into that state, they opened and shut their eyes, when my fingers were released from pressing their eyelids. They kept on blinking the eyes. The lids came nearer together and finally closed. The same process of blinking was observed on waking; they seemed to wake and fall asleep again, thus being really in the intermediary, hypnoidal state, hovering between waking state and sleep, both on going to and coming out of sleep.

With the repetition of the experiments the little fellows learned to go to sleep with greater and greater ease, manifesting, as time went on, more and more clearly the characteristic symptoms of subwaking and sleep states. After a time there was no need to keep their eyelids closed with my fingers; it was enough to shade their eyes with my hand or with any opaque body and the eyes after a few seconds began gradually to close. A slight tremor of the eyelids was observed as they kept on opening and closing, somewhat similar to what we find in the first stages of hypnosis. Only here it was not really hypnosis, but the hypnoidal state, partaking of hypnosis, waking state and sleep. The puppies did not really go into any hypnosis, but into something bordering closely on the hypnotic state. Instead of going

into the hypnotic state, however, as the fully developed human subject would occasionally do, the puppies went into sleep.

What interested me most in the puppies was the fact of their habituation to the sleep-procedures. They seemed to like the whole procedure and had no objection to my manipulations, so that after a time I even ventured to put them to sleep on the table without wrapping the cloth round their limbs; the little fellows went to sleep as cheerfully and as soundly as before. They lost all fear and lent themselves readily to the operations. It was thus sufficient for me just to put them down on their sides, and it did not matter on which (they would not sleep on their backs), when the puppies, of their own account, almost, went into their customary subwaking and sleep-states.

Those puppies were gone and another puppy, an untrained one of the same litter, had taken their place. This little fellow was about a couple of months old and was a hard nut to crack. He was sturdy, fat and refractory. I had quite a tussle with him. It took me more than half an hour to appease him. He became quiet for a few minutes and seemed to have gone off into a passive condition closely bordering on sleep, but he was soon up and in arms again. Maybe the loud knocking in the adjoining room disturbed the experiments.

I wrapped him all round in the cloth and shutting his eyes firmly with my fingers and holding him down tightly with my hands, I finally succeeded in moderating his ardent temper. The loud barking gradually subsided, and finally degenerated into growling. This growling really added to the monotony of the sensations. The growling then diminished and the little fellow began to breathe more quietly, the heart-beat due to excitement subsided, and the puppy fell asleep. He slept quietly for about ten minutes only and woke up again. His eyes looked sleepy and he yawned for some time.

An attempt was made to put him to sleep under the same conditions of monotony and limitation, but it was difficult to quiet him. He barked and struggled and refused to let himself be controlled. It was decided to let

him go for that day. This condition kept on for several days. The most that could be done with him was to wrap him in the cloth, hold him firmly with the hands, and have his mouth shut.

I confess that at first I almost despaired of ever breaking the youngster into the game. I kept at him, however, and after a long series of trials the little fellow did not meet me any longer with such feelings of opposition. Finally one day after a hard tussle and a few severe shakings I decided to leave him to himself. To my great surprise the puppy became quiet, his eyes became perceptibly narrower, and at last he fell asleep. The sleep was very sound. He did not open his eyes when I changed the position of his paws, nor did he even open his eyes when I tickled the paws or pricked them. The only response to those stimulations was the reflex movement of the paws, drawing them away from the direction of the stimulus. The eyes were firmly shut, and when I attempted to separate the eyelids, the latter resisted quite perceptibly my efforts. When I did open the eyelids, the eyeballs rolled up and the pupil was contracted. The puppy slept for about half an hour. I decided to awaken him and see what he would do and also to observe the stages which he would pass in getting out of the sleep-state. The cloth was unrolled. This awakened him. He opened his eyelids, stretched his forepaws and was going to sleep again; the eyes closed. On testing his forepaws, there was some resistance, though very slight, but it could be noticed on attempting to bend the paw at the joint. The eyes opened and closed; finally they opened fully and the little fellow stretched out his paws and yawned with a good relish as after a delightful sleep. At last then my long efforts were crowned with success. The puppy did fall asleep and in waking was observed to pass through the characteristic stages of hypnoidal states.

The advantageous moment was then seized to push the matter for all it was worth, to again induce sleep under the conditions of monotony and limitation now that the puppy proved so obliging and went off into sleep on its own account. The cloth was wrapped round the puppy's limbs

holding him down firmly. I closed his eyes with my fingers; the puppy, having been just awakened from his deep sleep, felt more gracious and did not kick much, opposed but little and in a few minutes fell into a deep sleep. After sleeping for about a quarter of an hour he was awakened. On awakening for a brief period the presence of the intermediary, subwaking, hypnoidal state was observed. I immediately proceeded to put him to sleep again, giving him no respite and plunging him rapidly in succession from waking into sleep and then again from sleep into waking states. This process was kept up a few times until it was quite certain that the little fellow was under control. The puppy got thus habituated to manipulations as well as to the rapid transitions from waking to sleeping and back again. Every time he was brought out of sleep the puppy was very quiet and did not resist my efforts to put him to sleep again. At first I did not dare to observe closely and especially to experiment on the first stages of going into sleep, lest I might disturb the puppy and thus break the charm, as I was anxious that he should first of all be habituated to the process and to the sleep-states under the conditions of monotony and limitation and should cease to show resistance. After a number of experiments the puppy became tractable and thenceforth the experiments could be carried on without any further protests and rows on his part.

From now on the experiments proceeded in peace. When occasionally the little fellow became obstreperous, a few shakings brought him to his senses.

After wrapping the puppy in the cloth, and holding him firmly with both hands, I closed his eyes with my fingers. After a few seconds the puppy fell asleep. The eyelids were firmly closed. When an attempt was made to open them, they resisted; when the eyelids were separated forcibly, the eyeballs were found rolled up. There was contraction of the pupils and when darkened with the palm of my hand, the reaction was very sluggish. When the conjunctiva was touched with my fingers, there was a slight reaction of closing the eyelids and slight shifting of head and body, but the puppy remained asleep. He slept

for about half an hour and was awakened for further experimentation. On awakening, the puppy passed as usual through the transient subwaking state characterized by slight catalepsy of the extremities.

The puppy was put to sleep again with the cloth about his extremities; the forepaws were more or less loosened for observation and experimentation. The head was left protruded out of the cloth so as to observe the changes. This condition was always observed in my experiments on sleep, only in some cases the head was kept a little covered so as to keep out the light. In this case I had the head fully uncovered. My fingers were kept on the puppy's eyelids, but I removed them in a few seconds. The eyelids were found partly closed and I observed a peculiar tremor of the eyelids similar to that found in human subjects before falling into the hypnotic state. The eyes of the puppy were shaded with the palm of the hand. Gradually the eyelids closed tremulously. It could be distinctly seen how they opened partly, and then closed again. After the eyelids became fully shut, a peculiar phenomenon strikingly analogous to one manifested in hypnotic subjects, was observed; the puppy seemed to try to open the eyes but could not do it. He tried evidently quite hard to raise the eyelids, but only succeeded in raising a part of the lids, thus exposing a slit of the sclera; the eyeballs in this ineffectual effort of the puppy to open its eyes were seen to be rolled up. The eyelids closed again. The efforts on the part of the puppy to open its eyes were repeated a few times and each time the attempts were in vain. The eyelids then closed and remained so. This is so striking and so similar to what is observed in the hypnotic subjects that one is almost tempted to describe this condition as hypnosis. At any rate one is justified in saying that we observe here a *phenomenon which is strikingly analogous to the hypnoidal state.* In going, then, into the sleep-state the puppy passed through a state which is evidently on the borderland of sleep and what in the human subject is described as hypnoidal. This borderland state forming an intermediary state between waking on the one hand, hypnosis or sleep on the other, is just what characterizes the subwaking, hypnoidal

state. There seemed little doubt that in going into sleep the puppy did pass through hypnoidal states.

Another fact that may be of interest in the sleep of this puppy, as well as of the other puppies under observation, was the shivering in going to sleep. The extremities trembled when raised and a transient state of resistance and catalepsy was often observed. This catalepsy was specially pronounced when the forepaw or any other of the extremities was extended and a little manipulated. It seems as if we give here a suggestion to the puppy, as is the case with the state of abnormal suggestibility in the human subject. I may add that these manifestations of the hypnoidal state were not so marked on awakening.

After control was gained over the puppy he could be handled safely. It was thought it might be well for the sake of the experiment to irritate the dog a little and see what would be the result. He was forcibly pressed and choked very slowly so as to avoid the sudden onset of excitement. He yelped, but it seemed that the habit of going to sleep was even stronger than the excitement. In spite of all the irritation the puppy soon became quiet and when his hind limbs were wrapped around, he soon was disposed to fall asleep. With my fingers I just covered his eyelids, but did not press on them. It was just the merest suggestion of pressure on the eyes, but the little fellow went into a sound sleep. Before falling asleep I observed the usual blinking of the eyes, the opening and closing of the eyelids and twitching of the orbicularis palpebrarum as well as the rise and fall of the eyelids until the eye became completely closed. On attempting to open the eyelids there was great difficulty in separating them. On examination the eyeball was found to be rolled up, the pupil contracted and not reacting to light. The conjunctiva was found almost insensitive. The dog responded to stimulations by reflexes of the forelimbs and on stronger stimulations by movements also of the hind limbs, but he did not wake up. At first the limbs were slightly resistive, especially when I manipulated them, pressing and kneading the muscles of the upper front leg. The cataleptic state of the extremities was, as usual, only transient and the limbs remained

during the whole state of sleep in a condition of relaxation. The same state, though slighter, was as usually, also present when the dog was aroused from his sleep by a summation of stimuli.

The sleep-experiments were carried out on this formerly refractory puppy with great ease. In fact, the facility with which sleep was induced far exceeded the experiments performed on any of the animals handled before. It could only be compared to the ease with which a subject on repetition of hypnotization goes into hypnosis. Still it is not possible to regard the sleep of the puppy as hypnosis. There is no suggestibility present, nor that characteristic *psychophysiological plasticity of associations and dissociations during or after hypnosis.* The state in which the puppy falls is nothing else than normal sleep. Only in passing into that condition *there are present manifestations which recall the hypnotic state.* The reason is very simple, the puppy is passing through a state which is intermediary in character between waking state and sleep. This intermediary state is hypnoidal in nature and has some manifestations which are analogous to hypnosis in the higher and more developed mental states of man. In the dog we have the foreshadowing of what is afterwards fully found in man alone. *The hypnoidal state precedes and succeeds sleep.*

As I continued my sleep-experiments on the puppy, it became easier and easier to put the little one to sleep; so much so that after a time I could put the puppy into sleep, first passing through all the stages observed, though the cloth, that magic for the induction of sleep, was no longer used. I put the puppy on the table, just kept him quiet by patting him a little, and pretty soon off the little fellow went into the land of Nod.

The puppy was put on the table, then laid down on his side—he did not resist, he kept as quiet as a little lamb. His eyes were shaded with a screen and the little fellow marched off into sleep. To produce sleep in the puppy after a few weeks' training was just child's play. The contrast to his previous unmanageable condition was great indeed. It was now possible with the greatest ease to have

him pass from sleep to waking and from waking to sleep. The contrast here was also very surprising, the puppy played, ran around, barked violently and in a few moments he was fast asleep with limbs relaxed and immovable, with eyes firmly closed, eyeballs rolled up, pupils contracted, conjunctiva anæsthetic, and all the sense-organs dulled and stupefied, as if by a hypnotic or anæsthetic. In a few moments more the puppy was up again, gave a yawn or two and was as restless and playful as ever. The transition from one state into the other was so rapid that it was almost marvellous.

The puppy was found very restless, barking and jumping, but as soon as he was put on the table, his limbs were kept quiet for a few moments, his eyes shaded; his eyelids began to blink and the muscles around the eyes to twitch, and the fellow began to shiver, not from fear, as the heart-beat was not accelerated, but slower, and the respiration was tranquil and lowered. The shivering was one of the phenomena observed in puppies, when on their way into sleep. What was specially interesting in the series of sleep-experiments was not only the significant fact that the puppy under the conditions of monotony and limitations was going off into sleep without resistance and delay, but that before going to sleep, when the eyes were about to begin to blink, and the eye-muscles to twitch, the *little fellow raised his eyes to me and looked at me and then, as if satisfied that everything was all right, off he went into his sleep contentedly.* This state is often observed in the hypnotic subject.

It seemed to me worth while to test whether the personality of the experimenter had any influence. When putting the puppy to sleep, I called Dr. Cannon to see it to test the phenomena of the subwaking hypnoidal state. To my great surprise I found that I could not succeed with the puppy as well. There was some difficulty in putting him to sleep, although there was not really active resistance. It took me some time before I could put the puppy to sleep and then test for the hypnoidal state and show it to Dr. Cannon. *There seems then to be a true personality-element present in the experiments.*

I then left the puppy for about a week. I wanted to see whether it would make any difference in the ease of putting him into the sleeping condition. After more than a week, I found that he did not submit so cheerfully as before. It took me fully ten minutes to put him in a state of sleep. Finally he did go into a sleeping condition with all the symptoms characteristic of the subwaking and sleeping state. In about a quarter of an hour he woke up, but soon fell asleep again and slept for another half hour, after which he was awakened. He seemed sleepy and looked ready to go to sleep again, which he really did after I had kept his limbs and body quiet for a few seconds and the eyes shaded. Thus the habit was quickly re-established.

To bring the personality-coefficient, so to say, more to the foreground, I decided that the dog should be put to sleep under the same conditions of monotony and limitation, not by me, but by another person. I asked Mrs. S. to lend me a hand in the present experiments and see what she could do with the puppy in putting it to sleep. The puppy was kept quiet on the table without being put into the cloth as I had been lately conducting my experiments; but the result was not successful. Mrs S. then resorted to the old conditions, namely to the cloth. The puppy went to sleep, but after some considerable trouble, though I must say he did not show any fight as I should have expected. It was then easy enough to put him to sleep without any cloth, though Mrs. S. could not accomplish it as easily as I could. *There is then present a personality-coefficient* in putting the puppy to sleep, but the coefficient is very slight in the puppy at least. *The conditions of hypnoidal states and sleep, namely monotony and limitation, are the most important.* For Mrs. S. could put the puppy to sleep; it was only a matter of time. Monotony, limitation and inhibition may thus be regarded as the conditions under which we can induce in the dog sub-waking hypnoidal states and sleep.

I may add that I also carried out similar experiments on a dog of six months old. As the dog was used to me I had no difficulty in inducing sleep. I made him keep quiet and then closed his eyes firmly. He went to sleep. When I tried to open his eyes, they resisted. When I

opened them, I found the eyeballs rolled up, nictitating membrane over part of sclera, and pupils were contracted. There were present the same manifestations of hypnoidal states, the slight catalepsy on falling asleep and a similar, though somewhat slighter catalepsy on awakening. There was little difficulty in putting the dog to sleep. With the repetition of the experiments it was easier to put him into hypnoidal states and sleep under the conditions of monotony, limitations of voluntary movements and inhibition. The dog was very lively otherwise, but when put under the conditions of monotony and limitation of voluntary activity, he sank into a passive state and then into a state of sleep.

We see, then, that dogs are subject to the same condition of sleep-states as is the case with the other animals experimented upon. In fact the experiments on dogs bring out the fact that the conditions requisite to induce hypnoidal states in men also hold good in the case of dogs. The hypnoidal states, both on falling into, as well as rising from sleep, are far more pronounced in the dog than in the lower animals experimented upon; the states themselves come up far more closely to similar states observed in men under the same conditions of monotony, limitations and inhibition than they do in lower animals, such as the frog, the guinea-pig or the cat.

Phylogenetically regarded the hypnoidal is the primitive "rest-state" out of which sleep and hypnosis have become differentiated. The lower the animal the more insecure, the more instable are its "rest-states," The animal must be on the alert in its rest, and "sleep", if at all, with its eyes open, so to say. It must be quick to wake and run from danger or if it cannot get away, it must "freeze and feign death"; in other words it must be able for the sake of protection to fall into a state of catalepsy. Hence the rest-states must partake of waking, sleep and hypnosis, that is, must be essentially hypnoidal in character.

The experiments on dogs are more instructive than the ones carried out on the other animals, because they clearly bring out the general principle of monotony and limitation in the causation of sleep. *Diminution in the variability* of the volume of sensory impressions *brings about the state of sleep.*

## Chapter X

### *Experiments on Children*

THE experiments on animals were followed by experiments on children. The subjects were of different ages ranging from infants a few days old, to children twelve and thirteen years of age.

It is well known that children usually fall asleep more easily than adults; they sleep longer and also more soundly. This is specially the case with young children and particularly with infants. We know that an infant passes most of its time in sleep, when it does not eat. We should expect therefore that the material would readily lend itself to our present purpose of experimentation, — to the induction of sleep-states. Now as a matter of fact, I find that in a number of my cases dealing with children it is no difficult task to put them to sleep, or to induce some form of subwaking state, hypnoidal or other closely allied to it. The child easily falls into a subwaking hypnoidal state which may either pass into hypnosis or into sleep. When trying to put children to sleep I have often obtained a hypnotic condition and on the other hand when attempting to put my little patients into a hypnotic state I have only succeeded in putting them to sleep. Before going, however, into either the hypnotic or sleep-state, I observed by close examination the presence of the hypnoidal state induced under the conditions of monotony and limitation of voluntary movements.

Since limitation of the voluntary activity, limitation of the field of consciousness and inhibition all help to a greater monotony, we may characterize the whole set of conditions requisite for the induction of sleep as the conditions of *monotony*. In children and especially in infants voluntary activity and the field of consciousness are undeveloped and limited, we should expect that the child would form a far better soil than the adult for the induction of the intermediary sub-waking states and sleep. This is precisely what we find to be the case.

Moreover, the mind of the child, and more particularly of the infant, specially depends on muscular activity and on the wealth of incoming sensory impressions. That is why the child and the infant take such delight in motor activity,—in tasting, testing, and handling things. If now the motor activity is limited and the main source of sensory impressions, such as sight, is restricted, and if the environment is kept in a state of monotony, such as darkness and lack of auditory stimulations, or monotony is brought about by a continuous noise and buzzing of some instruments producing a uniform noise, the child, on account of the poverty of its inner mental life, easily falls into a subwaking hypnoidal state and then into sleep.

This ease of induction of sleep is furthered by the comparatively small amount of variability of conscious activity present in the child — the variability of mental content being an important factor in keeping up the freshness, continuity and qualitative intensity of consciousness. Now as the child depends entirely for the variability of its consciousness on muscular activity and external impressions, we can well realize that when those sources become limited and monotonous, the child falls under the influence of all the important conditions requisite for the induction of sleep. The child in short, has no inner wealth of mental life to fall upon; it has little, if any inner resources; that is why it falls an easy prey to sleep and hypnosis, when the external resources lose their variability, become uniform and monotonous.

It may be well, however, to point out the fact that the conditions of sleep are somewhat different in the case of infants of a few days or of but a few weeks old. Young infants sleep most of the time. The waking periods are brief and alternate with long periods of sleep. Really the infant's state is one of sleep and he only wakes to eat. We may characterize the infant's waking states as *feeding* periods. The perceptual world may be regarded as practically non-existent for the infant—ego and non-ego are absent. The external world is in a chaotic state with no interests, even instinctive ones, as yet present. The sensory organs are as yet undeveloped and the sensory elements are all incoördinated and unrelated. Even the raw ma-

terial going to make up the future world of the individual is still in an extremely imperfect state. In short, the material presented by the undeveloped sense-organs is chaotic, undifferentiated and is at its *minimum*. There is really no external world for the infant and whatever sensory impressions are present lack meaning and interest.

But if the sense-material coming from the sense-organs which is to build up the infinite wealth of the external world is still undeveloped and lacks all significance, it is quite different with the sensations coming from the internal organs, from the viscera. The visceral, organic sensations stand out in the foreground of what may be regarded as the infant's consciousness. Visceral, sensory material forms the main substance of the infant's universe. *Cœnæsthesis plays the predominant, if not the only rôle, in the life of the newborn.* We can fully realize the importance and significance of cœnæsthetic sensations in the case of the infant, because the processes of growth and nutritive functions are all engrossing. The newborn is a vegetative being; it is all belly, stomach; it is a little glutton, it has to grow and that very rapidly; it lives for that purpose — it eats and sleeps. The waking periods are sparse, short and far between, the infant wakes to eat, and when filled to the point of regurgitation, it sleeps.

In this respect it may be well to observe the characteristic motor reactions of the newborn; the sucking movements are the only ones that are well coördinated, responding regularly to external impressions. Thus in my experiments I have long ago described the interesting fact that in his early life the newborn responds to external stimulations with sucking movements. If the infant, for instance, is put to the breast and has his fill and the sucking movements stop, they will again be reinstated by any stimulations of his sense-organs. Make noise close to the infant's ears or throw some rays of light on his eyes, or tickle him, or cause him pain, or tug at the nipple, and the infant responds with sucking movements. In other words, all reactions of the newborn are coördinated and essentially adapted to nutritive purposes. *Nutrition and its psychic correlative, cœnæsthesis, form the essence of the infant's early life.*

It is therefore clear that the conditions of monotony of external sensations and of limitations of voluntary activity, an activity really absent, as well as limitation of the field of consciousness, can hardly be of any import in the young infant. The gnawing of hunger, intestinal discomfort and pain play the only important rôle. In the early life of the baby visceral activity and its concomitant cœnæsthesis possess the greatest amount and intensity of qualitative variability that keep up the limited consciousness of the waking state. When the child is hungry, it is fidgety, cries and is awake; when hunger is appeased, the waking state lapses and the baby falls asleep. The waking state is a brief passing phase in the feeding of the baby, a feeding phase which begins and terminates in sleep.

If now we take all that into consideration, we should not expect to meet with clearly defined subwaking states and sleep under the conditions of monotony and limitation in the case of the newborn as we find it to be the case in the lower animals a couple of weeks old, or as we find it in the fully developed man. The young of the lower animals have a shorter training period and have a far larger amount of ready made and easily developed instincts or psychomotor reactions than the baby. When the newborn is put under the conditions of monotony and limitation of the incoming external impressions and under restriction of voluntary activity which does not as yet exist in him, the results are necesarily unsatisfactory. If the infant is full to the point of regurgitation, it goes to sleep, and if it is hungry the closing of the eyes and the attempts to hold it down by force are often quite ineffectual. The baby keeps on crying to the great discomfiture of the experimenter. The easiest and possibly the best way to bring about monotony in the newborn is to soothe the youngster's bowels. If again the young baby has indigestion, stomach-ache and cramps, closure of the eyes and holding the little one quiet without permitting him to kick will hardly do. In such cases the best way is to bring about *monotony and limitation of cœnæsthesis*. Giving the baby to suckle may appease temporarily the active peristalsis of the intestines and the little fellow may pass into the land of Nod; or we may press

uniformly on the abdomen and keep on rocking the little body at a uniform rate. By thus effecting a *monotony and limitation of the bowel-consciousness and intestinal activity* we can bring about a state of sleep. Still, even in the very young infants I succeeded, when the little one happened to be specially well disposed, in putting it to sleep by keeping it very quiet and closing its eyes. In one case I succeeded in putting to sleep a refractory infant under the usual conditions of monotony and limitation by closure of eyes and holding down the baby's extremities from being too active. Usually, however, in very young babies I somewhat modified my proceedings of monotony and limitation by addressing myself to the baby's *inner intestinal consciousness*. In older babies and young children of over a year, I did not vary my usual proceedings in the induction of sleep under the conditions of monotony, limitation of voluntary activity and of the field of consciousness.

We may now pass to the experiments. I shall follow here the same course as in my account of the experimental work performed on the lower animals, I shall not burden the reader with unnecessary details, but shall give a few cases of experiments, typical of the rest.

Boy of twelve days; he was quiet; he looked into empty space, seemed not to be specially hungry nor ill disposed. I covered his eyes with my hand and restrained the movements of his limbs. He wriggled a little under the restraint, but soon became very quiet. When after a minute's time I removed my hand from his eyes, the eyelids remained shut. Breathing was quiet and uniform. I tried to pull apart the eyelids and found them resistive. When I forcibly separated his eyelids, I found the eyeballs rolled up, pupils contracted. He slept this way for a few minutes. When he awoke I made a second attempt to put him to sleep, but this time with no success. The little fellow wriggled and squirmed. The eyes rolled incoördinately and looked vacantly into space. Closure of his eyes was of no avail. I then modified the procedure, patted his back, soothed his belly, and shut out the light from his vacantly blinking eyes. Gradually the little man relaxed his eyelids, began to work them and fell asleep. This

time he slept for about a quarter of an hour. I then awakened him by summation of slight stimulations. During the course of awakening, I observed a short state of resistance in the extremities. He was again put to sleep in the same way and when going into sleep the same state of resistance and catalepsy of the extremities was observed. The sleeping state was very deep, inasmuch as the little fellow was not disturbed by any sensory stimulations and only a good shaking brought him out of this deep state of sleep.

A girl of ten days; very quiet. I restrained her motor exuberance and with the other hand I closed her eyes; she at first resisted and cried, but after a couple of minutes she fell asleep. Respiration, quiet and equable. Eyelids resisted attempts to pull them apart. Eyeballs were found rolled up; pupils were contracted. I made another attempt and found it somewhat more difficult, but the child became quiet, had eyes closed for a couple of minutes and opened them again. The third time the success was even less marked. I then once more resorted to my method of back patting, bowel-soothing, by rubbing and patting the abdomen and monotonous rocking movements. The little girl was evidently pacified and went to sleep. When falling asleep, there was a short stage of catalepsy, the raised hand remained for a short period, a few seconds, in the position given to it, then a state of relaxation set in. This relaxation of the limbs did not persist during sleep, but now and then I could succeed in giving a cataleptic attitude to the arm. Soon the arm dropped and then again it was possible to put it into a cataleptic condition. The sleep was evidently not stable; the little girl apparently kept on oscillating between sleep and waking state. It seems to me, however, that it is more probable that the sleep-state in young infants is *not differentiated* as it is in the case of adults or of older children. The phenomena of sleep also present some characteristics of hypnosis and hypnoidal states, possibly, because the states of hypnosis proper are as yet embryonic — hypnotic or hypnoidal manifestations thus appearing in sleep.

Boy of ten days. I had great difficulty in putting him to sleep by the ordinary methods of closure and restriction of muscular activity. I had to resort to my modi-

fied method — patting, tapping and rocking until he fell asleep. In passing into sleep there was a slight state of rigidity and catalepsy of the limbs which soon changed to one of relaxation, but in the middle of sleep, when tested again for catalepsy, he developed one but it passed off and could not be again noticed until several minutes later I tested during that interval; limbs were found to be in a state of relaxation.

The interesting fact about the infant's sleep is that once asleep the infant is not so easily roused. This fact is sometimes very striking, especially, when the child has had its fill, and still more, when it has had its bath. To arouse the infant from its sleep is then pretty difficult and I have worked hard over the baby before I could disturb its peaceful repose. Some of the infants I have occasionally found so deeply immersed in sleep that even shaking could not arouse them. I had to give up all attempts to bring them out of the state of Nirvana and had to wait for a more favorable occasion.

Girl seven days old. Ordinary ways of putting to sleep did not work here and I had to resort to the rocking, patting and tapping before my efforts were crowned with success. The girl fell asleep in a state of rigidity and catalepsy soon replaced by relaxation. The eyeballs were rolled up, but the child was restless. I put her again under the same conditions of monotony and this time she slept more peacefully — I had in fact, some difficulty in waking her. The state of awakening was characterized by a greater resistance of the limbs than the sleep-state. Still, even in her sleep I could now and then discover a cataleptic state. *The sleep of the infant appears to have a mixed symptomatology of sleep and hypnosis.* The characteristic manifestations of sleep, however, predominate.

Boy two weeks old. I left him in the same position, but only shut his eyes forcibly with my fingers for not more than twenty seconds. He opened the right eye after thirty seconds, and the left eye remained closed for a minute and a half. This incoördination is observed in young infants. He did not fall asleep, however, before I tried the monotonous rocking, the baby being placed with his

belly downwards resting on the palms of my hands thus causing a uniform pressure. In sleep I observed a cataleptiform state. Hands remained in the attitude given to them. This lasted for but a few seconds.

I can induce sleep in the boy by the following procedure which is really another modification of the conditions of monotony and limitation of muscular activity. I either rock him for a time, while sitting quietly in the chair or take him in my hands and walk around with him, which also induces monotonous rocking movements. During all this time I sing to him some monotonous ditty. Sleep is more rapid in its onset, when the belly is pressed with my hands uniformly. The boy's eyes begin to close, first becoming as if fixed, hazy and vacant. He closes the eyelids, opening and closing them alternately, the eye is fixed in the same direction. The eyelids then close, then half open. The slit of the eye becomes narrower and narrower and finally the eyelids close and open no more; the little fellow is sound asleep. If his position is left unchanged, he remains asleep for a very long time. If, however, he is put in the crib, he wakes in about five or ten minutes.

When the boy is six weeks old, I can induce in him sleep, by simply closing his eyelids and singing to him some monotonous ditty. When the boy is not tired and has had a good sleep before, he falls into a peculiar state. *He is apparently not asleep and still he is unable to open his eyes for a couple of minutes and even more.* When he is fatigued, he immediately goes into a deep sleep.

Boy three months old. Can easily be put to sleep by monotonous stimulations usually of the character described. When asleep, he is slightly cataleptic; the lethargic condition, however, predominates. The limbs remain for some time in the position given to them, although the position is a very uncomfortable one. When he rapidly falls into deep sleep, he often retains the limbs, especially the arms in the *same position*, however awkward, in which they were put at the moment when he fell asleep.

In following the course of the child's sleep-states, I find that between the sleeping and waking states there is frequently, in fact there is almost always present, an inter-

mediary period of semi-waking, semi-sleeping state, or what is found by me to be present in lower animals as well as in man, when falling asleep, namely a subwaking, intermediary, hypnoidal state. This state is of long duration, sometimes lasting several minutes. It begins with the contraction of the levator palpebrarum, with twitching and trembling of the eyelids, the eyes gazing vacantly into space. The eyelids open and close unequally, the eyeballs begin to turn up, the pupil is contracted. If in this state, he is addressed in a caressing way with which he is familiar and which in the full waking state he greets with a smile and a kick, he now *starts violently*, the limbs going up, and he utters his peculiar cry of *great fright*. Often, however, when he is in this intermediary hypnoidal condition instead of passing back to the waking state, he falls into a deep sleep. When passing from this hypnoidal state into sleep, he is often seen to smile and almost laugh, occasionally he makes movements of mastication, sometimes gives a start and a cry, and keeps on sleeping. It is a form of hypnagogic or even dream-hallucinations.

As to the states which form the transition stages between sleep and full awakening or the intermediary states in his getting out of sleep, I have often had the opportunity to observe the following spontaneous manifestations. When the soundly sleeping child is awakened by a noise, he throws up his arms, as if in fright, half opens his eyes and falls immediately asleep again. The fingers of the hands remain *open and extended, as if in a cataleptic state.* When I try to close them, I find them *resisting* and after a time they close gradually. The rest of the body is in a state of relaxation. I observed it accidentally as the result of an unintended noise, but I since tried to reproduce some similar sudden noises and obtained like results.

When the boy was three and a half months old, I put him to sleep under the usual conditions of monotony and limitations of muscular activity. He fell asleep, his right hand and fingers remaining in cataleptic state, he kept them in the same position when he went to sleep. The fingers were outstretched and the arm raised. I tried to bend one of the fingers, there was no resistance, but curiously enough

as we find it to be in hypnosis, *the finger soon returned to its former position.* The arm remained in the raised position for about three and a half minutes and then gradually dropped. The child remained quiet in this position of fully relaxed limbs for about four minutes then suddenly gave a subdued cry of distress, probably due to some dream; the arms went suddenly up, especially the left one which remained in *a raised position with fingers tightly closed.* This lasted for about two minutes and a half. I tried to open one of the fingers, and met with no resistance. I kept the finger in state of extension for about a minute: as soon as I let the finger go, it *returned to its original bent position.* I soon observed him roll his eyeballs under the still tightly shut eyelids; then he opened his eyes, smiled at me and fell asleep again. As he was falling asleep with eyelids closed I could see the eyeballs roll, while the face retained its smile for a couple of minutes longer, as if smiling in his sleep at me. The state is evidently an almost fully developed subwaking, hypnoidal phase, bordering on waking, hypnosis and sleep. In fact we observe here already the *suggestibility of hypnosis which is on the way to become differentiated from sleep and hypnoidal state.*

We may now give a rapid review of experiments carried out on older children ranging from the age of four to the age of fourteen. The hypnoidal states become more marked, the hypnotic and even somnambulistic states come to the foreground, and we find that when sleep is induced we often get mixed manifestations of a subconscious order. Mixed, however, and still ill-defined as they are, when compared with the adult states, both the subconscious and sleep states are induced under similar conditions of monotony and limitation of voluntary movements. In trying to induce sleep we may get a subconscious hypnotic state and on the other hand in making an attempt to bring about a hypnotic state, we may get a state of sleep. A good deal depends on the fact whether or not we have eliminated the other conditions requisite for hypnosis, but not for sleep. The indispensable conditions, however, both for hypnosis and sleep are monotony and limitation of voluntary activity. These conditions are all the more indispensable as we have demonstrated

from our experiments that in order to reach either hypnosis or sleep the intermediary, subwaking, hypnoidal state must first be passed through. This intermediary state between waking on the one hand and sleep and hypnosis on the other, can only be induced under the conditions of monotony and limitation of voluntary activity.

A boy of four was put in a dark room; the metronome was set going, beating slow measure. The child was told to lie down on a lounge, stretch out his hands and legs and keep perfectly quiet. His eyes were then shut. After a few minutes his respiration became lowered and regular. He ceased to reply when talked to. At first his arm showed some slight rigidity, but soon after, the arm fell into a state of relaxation. He was not in a hypnotic state as he did not answer any questions and did not take any suggestions. When after a quarter of an hour he was awakened, he did not remember anything about talking to him, nor could we obtain it of him by any methods reaching the subconscious. He was really asleep and did not perceive anything during that period. These experiments were repeated a number of times with the same results. I observed that unlike hypnosis which can be induced in rapid succession, one state not differing very much from the other, in this particular case as the induction of the state was repeated, it was more difficult to bring it about, the state became lighter and lighter and the child was brought out of it by talking to him.

Boy of seven. I put him in a darkened room. My electric battery was set going. I told him to keep quiet and shut his eyes. After a few minutes he began to yawn, I told him to stop. He stopped and I soon observed that his little hand clutched mine convulsively, I tried the arm, raised it; it remained in the same position. I then challenged him to open his eyes. He could not do it. I let him alone in a very passive condition; respiration regular and quiet. When after ten minutes I came to him again, I called him by name; he did not answer. When I began to talk to him, he woke up. During the ten minutes he passed into sleep. This transition from hypnosis into sleep was effected through the intermediacy of the hypnoidal

state which forms the borderland of the waking and sleeping states. The general conditions of monotony and limitation of voluntary activity that favor hypnosis also favor sleep.

Boy nine years of age. I put him into a chair, told him to be quiet and then closed his eyes. He was passive, answered my questions; could open his eyes when challenged. When, however, left alone with his eyes shut and his limbs relaxed, he was found to be fast asleep. He did not answer any questions, did not take any suggestions, did not react to stimulations of medium intensity. When spoken to sharply, he woke up. Both before and after the sleep-state there was a short period when the passivity was quite marked and some resistance as well as disposition to leave the limb where it was placed, although he changed the position of the limb when challenged. In passing then into sleep as well as out of it he passed through the intermediate hypnoidal state.

Girl of thirteen. When put under the conditions of monotony and limitation of voluntary activity, she fell from the transient hypnoidal state into hypnosis and thence into deep somnambulism. After an hour, when left to the monotonous state of her somnambulistic consciousness, she passed into typical sleep, as she ceased to answer questions and woke up when the questions and suggestions were given to her in the usual insistent way. From somnambulism she passed into sleep. On other occasions, when closely watched, it was observed that this transition was effected through the intermediary hypnoidal state. The girl passed from the waking state into hypnosis and somnambulism and then again back into the hypnoidal state and then fell into sleep.

Boy aged thirteen. I put him into a quiet state. Metronome was beating slowly. Voluntary movements of the boy were restricted. The boy was then told to close his eyes. I put my fingers over them and kept them shut for a few minutes. When I raised my hand, I found that his eyes remained closed. His arm, when raised remained in the same position. When his arm was bent, he could not extend it, but when after a few minutes I began to talk to him, he woke up. He was evidently in the hypnoidal state

on the way to hypnosis or to sleep. On another occasion he actually fell into hypnosis not being able to move his eyelids or his arms and even took various suggestions. After a few minutes he ceased to be in communication with me and when suggestions were given to him as they had been given to him before, he did not take them, but woke up when loudly spoken to. In other words he fell asleep, and the loud voice disturbed his sleep.

Boy of fourteen; he had difficulty in going to sleep under the conditions of monotony and limitation, but when these conditions were long continued, he finally went into the hypnoidal state. As I feared to disturb him by too much questioning I left him without change to his monotonous environment. After about a quarter of an hour he was fast asleep, snoring in the chair.

Thus we find that in infants and children, as in the lower animals, sleep, hypnosis, and hypnoidal states are intimately related, sleep presenting complex manifestations of subconscious states which become fully developed in the adult.

(*To be concluded*)

# COLORED THINKING

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IF I were to ask at random some one of my acquaintances the simple question: "what color is Saturday to you?" he would probably reply that the question, if not a very bad joke, was perfectly meaningless or he would assert with manifest confidence that it was and always had been, white or black or red or green or yellow or blue.

It is a matter of sober fact that there is a small minority of people perfectly healthy in body and mind who cannot visualize anything without its being present to them in some sort of color or other. In plain language, this might be called colored thinking, to the learned it is known as psychochromaesthesia. The colored thing in the mind or the colored concept is therefore a psychochrome, and a person who habitually thinks in this way is a psychochromaesthete or simply a "seer," as Mr. Francis Galton has suggested. Seers are psychological curiosities and psychological problems; such persons cannot think of the name of a day of the week, for example, without seeing it in color; so that, in the cases of four different people within my knowledge, Monday is always thought of as yellow, grey, blue and green respectively.

Chromatic conception must be sharply distinguished from chromatic sensation.

It is not for our present purpose necessary to go fully into the differences which psychologists affirm between a sensation and a concept. It may be sufficient to say that of the two the former, the presentation of sense, is the more simple, concrete, elementary and always involves the activity of a sense-organ, whereas the concept is the complex, abstract and non-elementary result of the action of mental synthesis.

Sensations, sights, sounds, touches, pressures, pains, odors, tastes, etc., are information-bringing results in consciousness of contact with the outer world, whereas conception is the technical term for "thinking about" anything, a sensation included.

When I think about the name of the month January — the name or word appears to me reddish, April is white, May yellow, the vowel *i* is always black, the letter *c* white, *r* is indigo blue, and *w* very dark purple.

Only by a determined conscious effort can I think of *b* as green or blue, for to me it must be, always is, black; to imagine August as anything but white seems to me an impossibility. There is an inherent definiteness, finality, constancy about each individual's psychochromes which is very striking.

Allied to this, but psychologically different, is the linking of one kind of sensation to another kind of sensation in some invariable and instantaneous association. Thus certain persons, when they hear a particular tone on the organ or violin or sung by a tenor or contralto voice, seem to hear it violet, if we may use such an expression, the actual sound of this particular tone arouses the mental picturing of violet. A certain French gentleman always *heard*, not merely thought of, the sound of the vowel *i* as green. These associations between two different varieties or modes of sensation are known as synaesthesiae.

Conversely a color can call up a sound, as in the classical case of John Locke's blind man to whom "scarlet" was like "the sound of a trumpet"; this is the earliest example of synaesthesia in literature that I know of.

Synaesthesiae are then such coupled sensations as colored sounds, colored tastes, colored odors, or in general any invariable linking together of two different varieties of sensation.

Two well-marked cases of synaesthesiae are described in his "Problems of Life and Mind" by the late Mr. George Henry Lewes — well known as the first husband of "George Eliot." Two brothers of the name of Nussbaumer experienced invariable associations between sounds and colors. Voices and certain musical tones aroused particular colors, and conversely certain colors always called up the same sounds. Blue, yellow, brown, violet were the colors oftenest aroused; black, white, red and green were never experienced.

Both the brothers experienced the same chromatic associations with sounds in more cases than they had dif-

ferent ones. Even in their dreams, dual sensations were present; thus a loud noise, beat of drum for instance, evoked in their dreams the same color to which it would have given rise had it been in the waking state.

Associations between hearing and the sense of color (chromaesthesia) are the commonest of synaesthesiae; in this country we call it "colored hearing," the French name it "L'audition colorée."

Quite a number of cases of this are to be found throughout the various psychological, physiological, and psychophysiological journals; more cases indeed than one unversed in such matters would imagine. To take a typical case of it analyzed by Professor Albertoni of Bologna in 1889: the hearing of *do* (*c*) was always associated with blue, mi (*e*) with yellow, *sol* (*g*) with red. This then was typical colored hearing, a synaesthesia, the auditory sensation of *c*, or *e* or *g* produced simultaneously the sensation of blue, yellow or red, respectively. But much more psychologically remarkable is the state of two persons who were red-blind, color-blind to red; who had what we here call "Daltonism," because the great English chemist Dalton was one of the first to describe the inability to perceive red and distinguish it, for instance, from green.

It was found that these red-blind people could not correctly name the note *g*; that is, could not recognize the tone which certain other persons had associated with red. Albertoni, writing in German, called this condition "Gehördaltonismus" or *Daltonismus auditivus* or auditory Daltonism. It was a psychical deafness depending on red-blindness.

More recently Monsieur Peillaube, editor of the Revue Philosophique, has reported on the cases of four persons, synaesthetes, who had well-marked colored hearing for vowel-sounds and organ-notes. This author calls attention to certain cases amongst musicians of definite associations between not only notes, musical instruments and colors, but between whole pieces of music and colors. Gounod, endeavoring to express the difference between the two languages, French and Italian, and giving his preference for the former, used the language of colors,

"Elle est moins riche de coloris, soit, mais elle est plus variée et plus fines de tintes."

But reports of such things as coupled sensations and psychochromaesthesia are not confined to the dry archives of severe science. In the recent psychologically interesting novel "In Subjection" * by the gifted writer Ellen Thornycroft Fowler (Mrs. A. L. Felkin) there is more than a passing allusion to colored thinking.

The chief character in the book, Isabel Seaton, is described in chapter X as always having been the percipient of psychochromes. She says that to her, *a*, *e*, *i*, *o* and *u* have in thought the colors green, blue, white, orange and purple, respectively. Even *w* and *y* are not left out in the uncolored cold, for *w* is red and *y* yellow.

Of this character it is further said that "ever since she can remember," the days of the week have always been associated with colors as follow: Monday green, Tuesday pink, Wednesday blue, Thursday brown, Friday purple, Saturday yellow and Sunday white.

In a private communication, Mrs. A. L. Felkin was good enough to inform me that in her mind the odd numbers have the "cold colors"—grey, black, blue, green,—and the even numbers the "warm colors"—red, yellow, brown, pink, purple and orange.

People well known to this authoress are also constantly associated with certain colors which have nothing at all to do with the colors most frequently worn bv them.

Nor is this all; to Mrs. A. L. Felkin a soprano voice is pale blue, green, yellow or white; a contralto pink, red, or violet; a tenor different shades of brown; basses black dark green or navy blue.[1]

These latter concepts are the only ones where each is not associated with one particular color; for a definiteness in the color called up and this invariableness of association are two strikingly constant characteristics of colored thinking.

The case of Isabel Seaton is, then, one of pure psycho-

*Hutchison & Co., Paternoster Row, London, 1906.

[1] For colors associated with the voices of well-known singers cf. B. Lumley's "*Reminiscences*" (1864).

chromaesthesia (chromatic conception) and of synaesthesia too, for the sounds of singing voices arouse colors as just detailed. I, on the other hand, have no synaesthesia, only psychochromaesthesia; thus no sound, either of a voice or anything else calls up in my mind a color or any other sensation, but the moment that I think intently and so visualise the *word "soprano,"* I see it written in white, the word "tenor" in brown, the word "bass" in black.

Now it seems evident that only those persons who tend to visualise, project outwards ("exteriorise") their thoughts (concepts) will be at all likely to experience colored thinking, that is, to be psychochromaesthetes; at any rate people differ widely in the facility with which they can visualise their mental images, some persons having a very feeble power of seeing things before "the mind's eye," others not being able to think of anything clearly until it is projected outwards.

Thus long ago Mr. Francis Galton in his "Inquiries into Human Faculty and its Development" (1883) came to the conclusion that in connection with this power of mentation, one could divide people up into "poor visuals" and "strong visuals" as regards either the presence of an object in thought or the memory of it. Some people, it is well known, can remember how to spell a particular word only when they see it written out before them, and are greatly helped by the "look" of the word — not its sound. Analogously, other people recall an event in history, for instance, by calling up before their mind the very page and place on the page in the book in which they first read of the incident; they are strong visuals.

Others again always think of the numerals as written out in space before them or above them: one distinguished neurologist of my acquaintance figures the numerals from 1 to 100 in the form of a ladder sloping up from left to right into the sky. Naturally these must have *some* chromatic character, meaning by "chromatic" white and black and grey as included amongst "colors."

These exteriorized thoughts may be called psychograms; things, as it were, written in or by the mind with a degree of distinctness beyond what is believed to be normal for the

majority of mankind. When these psychograms of numerals, letters, etc. are also seen colored as though produced by the sun shining through stained glass, they may be called either chromopsychograms or simply psychochromes, as Mr. Galton originally suggested. Mr. Galton in the appendix to his book gives some typical colored concepts and colored exteriorised thoughts; very peculiar looking diagrams they are, reminding us of Joseph's "coat-of-many-colors" or of Jacob's ladder treated chromatically.

What manner of people, it may be asked, are they who have synaesthesiae or psychochromaesthesia?

Mr. Galton is again the authority here; he says that "seers" are to be found amongst both men and women, and that "they are rather above than below the intellectual average"—truly a comfortable doctrine for those who are seers, to whom therefore the word psychochromaesthesia is almost as "blessed" as Mesopotamia. I have not been so fortunate as Mr. Galton in meeting with many people who were colored thinkers; the majority of those whom I have questioned on the subject were either incapable of understanding what was meant by chromatic conception or were disposed to treat the whole subject more in the spirit of hilarity than in that of introspection. Possibly some few who are true psychochromaesthetes shrink from confessing the fact under the impression that if it is not something to be ashamed of, it is at any rate a childish survival. In all probability, if an adequate study could be made of childish survivals into adult life, a very great deal of interest and instruction would arise for empirical psychology.

It must not be imagined that those who are colored thinkers are constantly plagued with vivid day-dreams or colored phantasmagoria; they are not the victims of visual hallucination. It is true that colored conception consists in the invariable association of a particular color with the notion or idea of a particular thing. When I think of "one hundred," the letters constituting these two words seem to me vaguely written out somewhere in dark brown ("Vandyck Brown" of paint-boxes). I could not if I chose think of 100 in pink or white; the whole idea of a hundred is to me essentially and unalterably a dark one.

Similarly with the hours of the day, since ever I learned to "read the clock," I have thought of the hours of the day and night as having color. Thus to me the hours P.M. are 1 brown, 2 yellow, 3 white, 4 black, 5 brown, 6 white, 7 magenta red, 8 black, 9 yellow, 10 black, 11 green and 12 yellow. I am incapable of thinking without a very decided effort of 2 P.M. and 9 P.M. as anything but yellow, or 10 P.M. as anything but black; it seems absolutely unnatural to me that 3 P.M. and 6 P.M. should be anything but white. But I am not incommoded by these chromatic associations, they do not obtrude themselves into my mental life, they are there as habitual, natural tincturings of my ideas; for, more or less distinctly, every word has for me a chromatic property.

All words seem capable of being divided up into:—
(1) the dark, and (2) the light, the former predominating.
Randoms examples of dark words are:—
Of nouns (concrete): man, tree, hill, book, night, horse, train, Rome, London.
Of nouns (abstract): duty, ruggedness, violence.
Of verbs: to die, to know, to rest, to walk, to ride.
Of adjectives: awful, diseased, wicked, evil, horrible, ready, dark.
Random examples of light words are: —
Of nouns (concrete): sea, child, silver, year, face, day, cart, Stockholm, Cairo.
Of nouns (abstract): sameness, haste, consciousness.
Of verbs: to cry, to scream, to sit, to swim, to teach.
Of adjectives: sweet, gracious, stupid, simple, shrewd, ghostly, sinful.

Of course certain words in which color is expressed or which name an object of a definite familiar color, are colored appropriately. The psychochrome of scarlet is scarlet; of white, white; of black, black; purple, purple; and so on.

Similarly the words "lily-of-the-valley" are white, and a "snowdrop" is white, but the *word* "crocus" is to me also white — although the flower is more often seen yellow than of any other color. Again the word "rose" is neither white nor bright red, but of a decidedly dark red as though

seen in feeble light. It is almost always the word and not the object which I "objectify." The word "grass" is not to me of the vivid green of grass as we know it in Britain, but of a much less saturated green, a grey-green. Again "Mr. Brown" does not call up before my mind the brown as of a bear's fur, but darker—almost black-brown. The *word* moon is white, *sun* is yellow, and *stars* white.

All this seems supremely arbitrary if not also meaningless, and the "explanation" of it very difficult to find. But coupled sensations or colored concepts are as much natural phenomena as the rising of the sun or the closing of a daisy. If we knew everything, Nature would have no difficulties and it would have no mysteries. Later on when we have learned all we can about the facts of this subject, we shall attempt an explanation; in the meantime there is more that we can find out by a survey of as many cases as we can bring together for comparison.

It was Mr. Francis Galton who, by comparing as large a number of psychochromes as possible, first enumerated for us the four or five characteristics of chromatic conception. The examination of such cases as I have been able to make and the introspection of my own experiences lead me to agree with Mr. Galton's analysis in every particular.

1. First, these associations between concepts and colors have been formed at a very early age. Mr. Galton's correspondents wrote: "Ever since childhood I have always seen," "as far back as I can remember I have always seen," and so forth. In my own case I believe that some of the psychochromes for hours of the day were fixed when I was five years old, and one of my nephews before he was seven had definite associations between colors and days of the week. In "Nature" for 1891 (Volume 44, p. 223) Mr. E. S. Holden reports on the psychochromes of his daughter when aged seven, at which time she had specific colors for the days of the week.

2. The next point which may be said to be a characteristic of psychochromes is their distinct individuality. The color I associate with the vowel *u* is the kind called "French grey," but it is yellow to one seer, black to a second, brown to a third, blue to a fourth, and green to a fifth.

These are quoted from tables of colored concepts compiled by me in 1905.* There is nothing like even a general agreement between the colors attached to the same concepts in the minds of seers. The one exception is when seers are members of the same family, but even in this case their psychochromes are not invariably the same. Nothing strikes me so forcibly on looking over lists of psychochromes as the endless variety of colors attached to the same concept. What is it that makes one person always think of August as white, another as yellow-brown, still another as crimson? The month of white harvest will not account for it, for the same person who thinks August white also thinks February, a month of no harvest, white. Again, if August is a white harvest month to any one person, it must be such to all persons capable of receiving any impressions from Nature at all, and yet some people see it brown and others crimson. The mystery deepens.

3. The third characteristic of psychochromes is their extreme definiteness in the minds of seers. It might be thought that colors attached to things so intangible as concepts would be vague, indefinite, hazy: as a matter of fact it is exactly the reverse.

The psychochromaesthete is not content with saying that, for instance, Sunday is yellow, he says it is "a very pale canary yellow." Another seer I know says that September is "steel grey," not merely grey. Some one else distinguishes between white and grey, between a bright white, a dull white, a silvery white, and so on. One French seer of whom I have records thinks the vowel "e" is grey-blue, another sees "s" as lemon-yellow not any other tint of yellow.

The degree of chromatic precision which can be given by seers to the description of their visualisings is surprising, as surprising as anything else in this most curious subject.

It is interesting that though so definite, these psychochromes never become hallucinations of the sane. Psychologically this is what is to be expected, because the hallucination is an exteriorised sensation produced without any

* On Psychochromaesthesia and Certain Synaesthesiae. Edinburgh Medical Journal, Dec. 1905.

adequate external cause, whereas the psychochrome is not a sensation at all but a concept.

Now sensations can be the bases of illusions and hallucinations in that they are related to environmental conditions, but a concept being wholly and always subjective cannot be the source of a hallucination: a hallucinatory concept is psychologically meaningless. A sensation can be the source of an error of judgment as to its origin in the environment, but a concept has no reference to the environment at all. This is probably a great part of the reason why these psychochromes never rise to the level of the vividness of a hallucination: they have all the definiteness of a thought without any of the verisimilitude of a subjective sensation.

4. The fourth distinguishing feature in psychochromaesthesia is that this mental faculty is hereditary, "very hereditary," as Mr. Galton puts it. In quite the majority of cases the power, if it may be so called, of thinking things colored has been innate, parents or remote ancestors having also possessed it.

We shall later revert to this point as it is theoretically important: if the faculty of colored thinking is parentally-derived, it is not also environmentally-produced. The importance of this will become evident later when we attempt to theorise on the condition.

The same seems true of synaesthesia: one of the latest French papers which I have seen is entitled: "Cas d'audition colorée hallucinatoire; cas hereditaire." And again, I have a reference to another paper emanating from France with the title: "Un cas héréditaire d'audition colorée.

A father, son and daughter, each associated the hearing of the names and also the thoughts of letters of the alphabet with definite colors, the vowels with gay colors, the consonants with shades of grey. The condition was hereditary in the second generation, and the idiosyncratic characteristic was also not wanting, for the father and son had different colors for the sound or thought of the same vowel.

The hereditary character so insisted on by Mr. Galton, I find wanting in one or two cases that have come under my notice. Mr. F. Holden (Nature, 1891, Vol. 44, p. 223),

the father of the child with such definite psychochromes, was himself perfectly unable to visualise numerals or anything else. By accident he discovered that his daughter was a seer. I can trace no hereditary influence in my own case, but one of my brothers and a boy of his think chromatically.

5. Lastly we have the characteristis of the unchangeableness of these colored concepts throughout life. It is the almost universal confession that they appear to the percipient now as they have always appeared; that they have undergone no changes during a life-time otherwise full of changes.

As for my own, I have known no change in them for thirty years, and my brother's experience is the same. On this point Mr. Galton remarks: "they are very little altered by the accidents of education."

Just as apparently their origination is not due to the influence of the environment, so the environment exercises no modifying influence over them as life proceeds: in other words they are unrelated to the environment. Even to this apparently universal law there is an exception, at least in the case of the child Holden, whose psychochromes altered as she grew older; but even this does not prove that the environment altered them. Mr. E. S. Holden reported on the changes of his daughter's psychochromes at 7, 8, 10½, 13, 14½ and 16½ years of age. But on scrutinising the tables, the amount and nature of change is quite insignificant; thus, the numeral 9 was green in 1885, blue in 1887, blue-green in 1889 and finally dark-blue in 1891. None of the other changes is of much more consequence. At 13 years old she thought of Friday as white, but later as cream-colored. Strictly speaking Miss Holden is not an exception to any of the outstanding features of a typical case of psychochromaesthesia.

Can we get any intelligible explanation or working theory of this extremely peculiar but not extremely rare condition? Does it seem capable of explanation by any of the theories of color-vision known to physiology?

Has it any obvious relation to the primary colors of the Young-Helmholtz theory,— red, green, blue-violet — or to

those of Hering's theory red and green, yellow and blue?

The answer to all these questions is in the negative. The total number of colors associated with concepts is perhaps not large, the following are the colors reported: — (1) Those in the spectrum, viz. red, orange, yellow, green, blue and violet, and (2) those not in the spectrum — white, black, grey (including all the varieties of grey), scarlet, cream, brown (with all the shades of brown), crimson, pink and purple.

The commonest chromatic conceptions seem to be white and brown, each occurring 23 or 24 times out of 100 psychochromes taken at random from those of four people, two men, one woman and one child. The rarest two colors associated seem to be orange and purple, they occur but once each in a 100 cases. I have analyzed 100 psychochromes of four persons to whom they belonged in the following proportions: 31, 31, 18 and 20 respectively. White constituted 24%, brown 24%, black 17%, yellow 11%, green 7%, blue 5%, red 4%, pink 3%, cream 3%, orange 1%, purple 1%. These figures do not show the colors as related more to one color-theory than the other; the primaries of the one would explain the occurrence of the colors as readily as would the primaries of the other; we can get no help in this direction. There is no suggestion amongst these data that allied concepts have allied colors, no hint that if one thing is red its opposite is green, or if black its opposite is white. We do not find that if "good" is colored green "bad" is red, nor that if "beautiful" is blue, "ugly" is yellow. As a matter of fact in my own mind "fair" is colored light, and "dark" *is* colored dark, but "fair" is pale yellow and "dark" is mouse-brown, and these are not opposites or complementaries on any theory.

Mrs. A. L. Felkin does indeed see the even numbers as "warm" colors (red, yellow, brown, pink, purple, orange), and the odd as "cold" colors (white, grey, black, blue, green), but even this though nearer to the ideas in Hering's theory, is not in accordance with them, for white and black are placed together in the same group as cold colors, whereas Hering regards them as the conscious correlates of oppositely-phased metabolic states. In short, then, although

in psychochromaesthesia all is not the absolute chaos which on a superficial inspection it might seem to be, still if there is a method in this chromatic madness it is certainly a very concealed one.

But another line of investigation may be pursued.

Do, for instance, the colors attached to the component letters of a word constitute, when mixed, the color of the entire psychochrome? Take the word "Tuesday": it is for me white, its component letters are colored thus: *t* blue-black, *u* grey, *e* brown, *s* yellow, *d* brown, *a* white, and *y* yellow, which on synthesis could not possibly "make" white. There are endless samples of this. In my own case I can, on the other hand, find a few cases where the colors of the components do seem to contribute to the whole, thus "gay" is light yellow: *g* and *y* are yellow and *a* is white, so that white and yellow *would* constitute a light yellow. Again, the word "ghost" is white (as is natural for a supernatural existence) and its components are as follows: *g* and *s* yellow, *o* white, and *t* bluish. Now on Hering's theory these *would* give white; for the yellow and blue mechanisms being simultaneously stimulated would yield no chromatic factor in consciousness, but as white katabolises the white component of the white-black substance, white would be produced.

This may be found to be accidentally true in a few cases, but in the vast majority it is not so. For instance the word "sea" is white, but *s* is yellow, *e* is brown and *a* alone white.

The color of the concept of a word is, then, rarely the color which would be formed by compounding the real colors of the conconstituent letters. We have cleared the ground to a certain extent, but have derived very little material for a theory or explanation of psychochromaesthesia. The writings of Monsieur Peillaube, however, have helped in explaining at any rate some cases of these associations. Monsieur Peillaube became acquainted with a gentleman, a Monsieur Ch——, who had *audition coloree* as well as psychochromaesthesia.

Monsieur Ch——, besides having an excellent memory, was able to submit his conceptions to a searching intro-

spection with the satisfactory result that he discovered what we may call the "missing link" in his associational chain of events chromatic. To Monsieur Ch——low notes, such as the low notes of the organ, are sweet and deep (*douces et profondes*), the color violet is also *douce et profonde*, therefore Monsieur Ch—— associated the color violet with low notes.

To Monsieur Ch——the vowel-sound of *i* was suggestive of something "vive et gaie," the color green had always seemed suggestive of liveliness and gaiety, therefore Monsieur Ch—— always thought the vowel *i* was green. These conclusions were reached only after considerable introspective analysis working in conjunction with a very good memory, for it must be understood that the link between the low notes on the one hand and the color violet on the other — the sweetness and depth — was by no means an explicit or definite presentation in the mind of Monsieur Ch—— at the time that Monsieur Peillaube first suggested to him the inquiry into the coloring of vowel-sounds or vowel-concepts.

Peillaube's theory then is that these apparently arbitrary and instantaneous linkings of colors ($x$) to sounds or concepts ($y$) are really, after all, cases of association of sensations or of concepts through the intermediation of a third factor, the emotional link ($l$), now subconscious but revivable. Thus the sequence was $x$-$l$-$y$ or $y$-$l$-$x$, the $l$ having long ago dropped out of consciousness, so that the $x$ and $y$ seem to be indissolubly bound together.

In other words, the existence in the past of some now forgotten emotional or other mental state is the causal link sought for as associating apparently so arbitrarily a color with a sound or concept. I believe that in this long past mental state we have the clue to the origin of some psychochromes at least in certain people. Some of my own illustrate this point.

The word February is to me white, the earliest February I can remember was snowy; so that, thrown into a syllogism we have —

Snow is associated with whiteness.
The earliest February I can remember was associated with snow;
Therefore, February is associated with whiteness.

Possibly if the now long-forgotten link could be discovered, a good many other associations would prove to have been similarly formed. At the same time it seems hopeless thus to explain such curious arbitrary psychochromes as October and December black, Monday deep yellow, Thursday white, Tuesday pink, Wednesday brown, 9 P.M. yellow, 11 P.M. green, or the vowel *u* white, yellow, black, brown, blue, green in six different persons respectively. Equally difficult of explanation is what is known as the person's "own color." Certain people have their favorite color, that is the color they habitually associate with themselves and what more particularly concerns them. Thus Mrs. A. L. Felkin writes: "The color which I always associate with myself for no earthly reason that I can discover is blue. Therefore F, my initial letter, is blue; April, the month of my birthday is blue; and nine, the date of my birthday is blue."

It is not unlikely that some picture-book may have been the cause at work in giving chromatic character to certain words or sets of words. But most people shrink from confessing to what they regard as nothing more than a childish revival. Few at any rate are so satisfactory as to the problem of the origin of their psychochromes as Monsieur Peillaube's subject, for a large majority questioned on this point by Mr. Galton replied: "I cannot account for their origin in any way."

In concluding I shall try to get more light on this fascinating subject by considering the whole tendency to associate colors with concepts in the light of the two fundamental properties of protoplasm, affectability and functional inertia.

The former property may be briefly described as that in virtue of which the living matter, whether tissue, organ or organism, responds to a stimulus; it is the property which puts living matter into relation to or correspondence with its environment, the property, in short, of accessibility to stimulation; whereas the other, which seven years ago I named functional inertia,[1] may be described as that property in virtue of which the living matter does *not* respond to a

[1] The functional inertia of protoplasm, Glas. Med. Jrl., 1901.

stimulus, whereby it is *not* in relation to or correspondence with its environment, the property, in short, of *in*accessibility to stimulation. This property of functional inertia is the one that underlies inheritance and all conditions describable as the maintenance of the *status quo ante.*

Now there seems to me, in the light of the above distinctions, no doubt whatever to which property psychochromaesthesia is related: it must be to that of functional inertia. The mental tendency, the result in consciousness of an antecedent cerebral tendency, is notoriously not one to be referred to the action of the environment, that is of any stimulation. The testimony of seers as to this is unanimous. External conditions they at once set aside as being causal factors in their psychochromes. In other words the tendency to form psychochromes is innate, inertial: it flows not from the reaction between environmental (educational) influences and protoplasmic affectability, but from certain little-known and non-acquired molecular dispositions in the protoplasm of the central nervous system in virtue of the functional inertia of which unalterable and arbitrary associations early unfold themselves to the consciousness of their percipient. We have abundant evidence as to the "very hereditary" character of both psychochromaesthesia and synaesthesia.

Being inertial, this cerebral tendency is inherited not acquired, is due to "Nature not nurture" in Mr. Galton's phrase, and, not resulting from the raise level or the environment, these psychochromes are, as we have seen, remarkably stable throughout life. As they are not caused by so they are not continually modified by the environment.

Psychochromaesthesia may in this way take its place in the same category as certain abnormal mental characteristics, propensities or powers. By "abnormal" I mean departing from the general average type of mind. Those who are psychochromaesthetes depart mentally somewhat from the average normal which of course is, intellectually considered, not of a high degree of attainment. But this departure from the intellectual dead level of the majority, not being one due to training, indicates some preadjusted cerebral tendency which may express itself as "genius"

in one member of a family, as some form of mental instability or peculiarity in a second, as a high degree of artistic or musical ability in a third, as the gift of scientific or philosophical insight in a fourth, as "insanity" in a fifth, as psychochromaesthesia in a sixth.

As we have seen according to Mr. Galton, seers are as a rule rather above than below the intellectual average. Those whom he mentions are George Bidder, Esqr., Q.C.; Dr. James Key, Cape Colony; The Rev. G. Henslow, Botanist; Baron von Osten-Sacken; Emeritus-Professor Schuster, F.R.S.; B. Woods Smith, Esqr.; and Colonel Yule, C.B. I could extend this list by adding the gifted novelist "Ellen Thornycroft Fowler," Professor Owen of Wisconsin, and Dr. Head, F.R.S., the able Neurologist and Editor of "Brain."

Genius is something notoriously not conferred by training or education, if not inherited it can never be acquired: the same may be said of psychochromaesthesia. These things show us that it is not in the ordinary type of mind, but in the recesses of the slightly aberrant that the more recondite problems of mental physiology present themselves to receive if not immediate solution at any rate such study as can alone lead to a satisfying hypothesis.

# EXPERIMENTS IN PSYCHO-GALVANIC REACTIONS FROM CO-CONSCIOUS (SUBCONSCIOUS) IDEAS IN A CASE OF MULTIPLE PERSONALITY

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THE following experiments were undertaken with the view of determining: — first, whether in the psycho-galvanic reaction of Tarchanoff we should be able to obtain physical corroboration of the evidence for co-conscious or split-off ideas; and, second, assuming such ideas to have been demonstrated by other methods, to what extent, if at all, they could affect the galvanic reactions to word-stimuli. The term "co-conscious" is used as equivalent to subconscious ideas actually present and functioning — *i.e.*, co-active ideas. As to the first object, it should be explained that, although a large and still accumulating mass of evidence has shown, under certain pathological and other conditions, the presence of co-conscious processes of which the subject is unaware and yet which manifest themselves through intelligent actions, still all writers are not in accord as to the interpretation which shall be put upon these manifestations. While we believe all students of abnormal psychology — those who have done the experimental work — are in agreement in interpreting subconscious manifestations as the expression of co-conscious ideas more or less dissociated from the personal consciousness — that is to say, they are agreed on the psychological interpretation — there are certain theoretical psychologists who still insist that all such subconscious manifestations are compatible with the interpretation that they are a result of physiological processes without any association with ideas whatsoever. This is the physiological interpretation.* It is therefore desirable to obtain evidence which will determine which of these two interpretations is correct. It seemed to us that Tarchanoff's

* See Symposium on the Subconscious, JOURNAL OF ABNORMAL PSYCHOLOGY, April-May and June-July, 1907.

"Galvanic Reaction" might throw some light upon the interpretation of subconscious phenomena. It will be remembered that Tarchanoff, Veraguth, Jung and others have shown that when a weak electric current is passed through the body and, at a given moment, an emotional tone is evoked by arousing some idea that has an emotion associated with it, at that moment the electrical current becomes increased. This increase is due, probably, to a diminished resistance of the skin brought about by the emotion. Now, if a galvanometer is placed in the circuit and so arranged that a ray of light, falling upon the mirror of the galvanometer is reflected upon a scale, then with every increase of the current the light will travel along the scale. Accordingly, whenever, through a given stimulation, an emotional tone is aroused in the subject, there is an increase of electrical current and a movement of the light along a greater or less number of degrees upon the scale. By measuring these degrees of movement and plotting the oscillations upon a chart, a curve can be constructed, or, by the special contrivance of Jung, the oscillations of light can be recorded on a revolving drum (kymograph); this latter apparatus we used in our experiments. By using the well-known method of word stimulation, thus arousing various associated ideas with their emotions, a series of reactions can be obtained which record themselves through the oscillations of the light on the kymograph.

In the experimental work thus far done, whether by the galvanic method or the more common word-association tests, the reactions obtained have been, in certain cases, interpreted as due to subconscious ideas, but the term "subconscious" has been rather vaguely used. It has so many different meanings that it is difficult to make sure in what sense it is used by those who would explain certain psychological phenomena by it. In this account the term "subconscious" is used in the sense of "co-conscious" which is also employed as a synonym, meaning split-off, dissociated ideas of which the subject is usually not aware, *but which, nevertheless, are in activity at a given moment. "Co-conscious" therefore implies doubling of consciousness.*[1]

[1] "Co-conscious" is not the equivalent of "unconscious" (das Unbewusste) as used by Freud, Jung, and others.

In previous experiments, too, it has been necessary to infer the presence of co-conscious (subconscious) ideas, (if that has been the interpretation), from the occurrence of the galvanic reaction or word association, and then to correlate the reaction with the inferred factor. It is desirable, therefore, that we should be able to have other evidence of the occurrence of both factors between which we seek a correlation, — between, in this case, "subconscious" processes (whether physiological or psychological) on the one hand, and the galvanic reaction on the other.

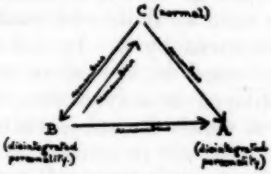
For this purpose it is essential that the subject should be one in whom subconscious processes can be shown to exist by the methods commonly employed in investigation in abnormal psychology.

The subject, B. A., whom we made use of, is one who is particularly favorable for such experiments. It is a case of multiple personality in which one of the personalities claims to be co-conscious with the other.

In order that the experiments may be intelligible it will be necessary to briefly explain the relations of the personalities to one another.[1]

The normal personality is known as C. This personality divides up into two others, one of whom is known as A, and the other as B. C is aware of herself in both the other states, A and B. On the other hand, A has no knowledge of either the normal self C, or of her sister disintegrated personality B. B, on the contrary, has a complete memory for the times when she is her disintegrated sister A, or the normal C.

This relationship may be diagrammatically expressed as follows. The arrows show the direction of knowledge.

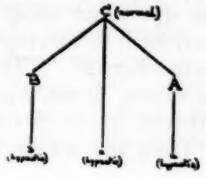



[1] This is the same case made use of by one of the writers in the series of "Experiments to Determine Co-conscious (Subconscious) Ideation"; JOURNAL OF ABNORMAL PSYCHOLOGY. Vol. III., No. 1.

The reason why B remembers the other two personalities is because, as she claims, *she exists as a co-consciousness during the lives of A and C respectively*, and as such a co-consciousness she claims to have a stream of ideas of her own, distinct from the stream of consciousness of the primary personality.

Accordingly, it is clear that B is both an alternating and a subconscious personality. That is to say, when A and C disappear, co-conscious B remains as the sole personality in existence and is then no longer a co-conscious, but an alternating personality. When A or C is present, B's memories persist co-conscious with the respective primary personality. It will therefore follow that any experiences which B has had as an *alternating* personality she would remember as a co-consciousness when A is present, although A would have no recollection of them. And it is clear that, if these co-conscious memories by certain technical methods could be awakened, we might get galvanic reactions therefrom of the source of which A would not be aware. The same would not be true of C, however, because she has a memory of B as an alternating personality; but inasmuch as B, when *co-conscious* with C, has separate perceptions and ideas of which C is unaware, if these co-conscious ideas and perceptions could be tapped while C is present we might get galvanic reactions from this source of which C would be necessarily unaware. Furthermore, there are other co-conscious memories, to be presently described, of which neither A nor C have knowledge.

A, B and C can be hypnotized and then there result three respective and distinctly different hypnotic states corresponding to each of the personalities, namely a, b, c. To show this more clearly, our diagram may be further enlarged as follows:



None of the personalities, A, B or C, has any memory for the hypnotic states.

As to the memories of these hypnotic states, it will be sufficient for our purposes here to state that only b (like B, as shown by other experimental evidence) is *co-conscious* with the other two as well as with the primary personalities, A and C; b is not co-conscious with B, but rather is that personality in the usual dissociated form; both are substantially one. Now it happens that the subject has dreams of which two of the three primary personalities, viz. A and C, have no memory on waking. B and b, however, remember the dreams. Consequently if b is co-conscious with *all* the other states, it would follow that, if we could tap these co-conscious memories of dreams while the primary personalities were present, we might get galvanic reactions of the source of which A and C were unaware.

These principles were made use of in the following experiments. If they are not clear now, they will become so as the experiments are detailed.

I. *Experiments to test the presence of co-conscious emotions in A and C connected with co-conscious memories of dreams and other experiences of which the subject had no recollection when awake.*

As already stated, the subject frequently had dreams of which neither A nor C had any recollection after waking. The occurrence of such dreams was obtained from one or other of the hypnotic states, each of whom remembered distinctly the dream and narrated it in all its details. The hypnotic state, b, gave the following accounts (corroborated by a and c) of two nightmares. I condense them, giving only the relevant details.

In the first dream she thought she was in a *boat* with a companion, under particular circumstances which I omit. A great storm came up. The wind blew and the *waves* grew high and threatened to swamp the boat which she was obliged to manage herself. "The boat went up, up, up and then down, down, down," and "the waves filled the boat and smothered us in foam." Then her companion was gone. Then the waves turned to *cats* which

came down "all over her," filling the boat. (At this point, in describing the cats, the subject, who has cat-phobia, shuddered and seemed horror-stricken. In describing the scene, particularly in speaking of the waves and the cats, the subject was filled with lively emotions.)

In the second dream she thought she was in a dark *canon* through which she was making her way. It was very dark and the sides of the cañon were covered with *stones*. After reciting in an emotional manner how she tried to make her way through the cañon in darkness, she said that the stones turned to cats and overwhelmed her. As in the other dream, she was filled with lively emotions during the description.

b, it will be remembered, claims to be co-conscious during all the waking states. In addition to reciting the dreams, she now gave an account of an episode which had occurred in the dining car on the journey in company with one of us (M. P.) to New York when C was "awake." b claimed that, during dinner, she co-consciously had seen a lady dressed in black (Mrs. X, whom M. P. knew and who was sitting some seats behind) look her over with her *lorgnette* in, what appeared to her, a somewhat offensive manner. This action had made b co-consciously angry or at least resentful. She said that she (co-consciously) felt at the time that she would like to put the lady out of the car. b had seen her at a moment when C had turned her head and she felt certain that the latter had not noticed the lady, for if she had she would have *thought* of the affair and b would have known her thoughts. b herself suggested this episode as a test, as the fact of the occurrence could be verified by questioning the lady in black, Mrs. X.

After the galvanic experiment was finished, C was questioned as to her memory. She had no recollection of having noticed the episode. Furthermore, as it was C who was in the dining-car, and as A, on whom the first experiment was made, has complete amnesia for the life of C, *she could not have had and, as a fact, did not have, any conscious knowledge of the lorgnette episode.* The testimony of the "lady in black", later obtained, substantiated the account of the episode. It is important to bear in mind

that b, when subconscious, as she claimed, remembered the dream and the episode.

Experiment 1. Accordingly, to test the presence of a subconscious emotion connected with the dreams and the dining-car experience, the words "waves," "boat," "cañon," "lorgnette," "stones" were interspersed among a number of other indifferent words, to wit: — [1]minister, [2]poor, [3]neck, [4]*waves*, [5]grass, [6]false, [7]belt, [8]flower, [9]*boat*, [10]kind, [11]pride, [12]seek, [13]*cañon*, [14]rich, [15]leaf, [16]travel, [17]*lorgnette*, [18]trust, [19]busy, [20]downstairs, [21]nobody, [22]*stones*, [23]big, [24]trees, [25]give, [26]sofa.

The galvanic experiment was made first, as I have said, with A. The curves obtained are shown in Figure 1. It will be seen that marked rises in the curve occur at 4

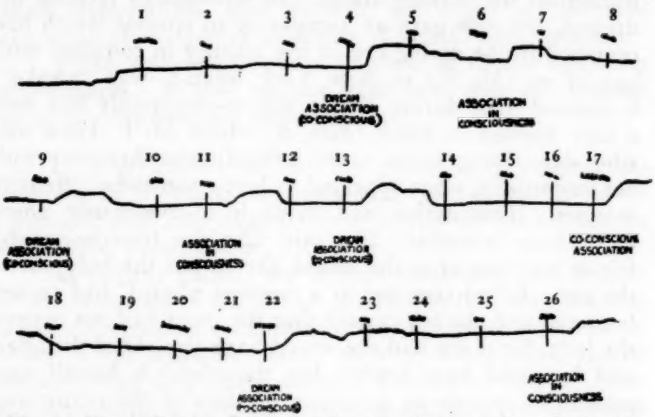



Fig. 1. Personality A. Dreams and co-conscious experience (lorgnette). [The tracing is cut into three parts.]

(waves), 9 (boat), 13 (cañon), 17 (lorgnette), 22 (stones). All these rises must have been connected with subconscious associations as the subject had no conscious knowledge whatsoever of her dreams or the lorgnette experience, while they corresponded with the actual dream and subconscious experiences as narrated by the hypnotic states a and b. It will be further seen that there are other rises at 6 (false), 11 (pride) and at 26 (sofa). These are refer-

able to corresponding *conscious* experiences of A, the first two of which are known to one of us (M. P.), the subject herself explaining them.

Experiment 2. On the next day the same experiment was repeated with C. The alterations in the curve (of which only the portions corresponding to "cañon" and

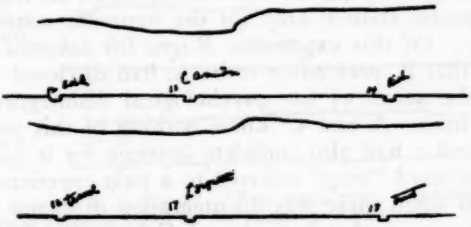


Fig. 2. Personality C. Test experiences same as Fig. 1

"lorgnette" are here reproduced, Figure 2) are not as marked as with A, and with two words ("boat" and "stones") connected with subconscious experiences, and one word ("false") connected with conscious experiences, no rise occurred at all.

This may have been due to the fact that the experiment was a repetition, and therefore the words may have both consciously and co-consciously lost something of their emotional tone on the one hand, and on the other (as respects the word "false"), C, having a full knowledge of the previous experiment with A, not only knew what to expect but, being more stable and normal, is less emotionally affected by any experience.

Nevertheless, it will be seen that there is a readily recognizable rise at 13 (cañon) and 17 (lorgnette).

These two tracings, and subsequent ones, should be compared with Figure 3, taken at rest. This tracing is, comparatively, a straight line.

Fig. 3. Rest Curve.

II. *Relative co-conscious and conscious reactions in different hypnotic states (a, b and c) to same emotions.*

To test the relative reactions of the different hypnotic states a, b, c, to the same subconscious and conscious memories, the test words "Smith" and "ring" were used and finally tactile stimulation. Of the test words, "Smith" referred to an experience in B's life of which the corresponding hypnotic state b only (of the hypnotic states) had a memory. Of this experience *B now felt ashamed.* It appeared that B, pretending to be A, had disclosed to a Mr. Smith the secret of her psychological disintegration into personalities. A and C* knew nothing of this and therefore a and c had also complete amnesia for it.

The word "ring" referred to a past experience in the life of B when there was disintegration of character without amnesia, so that both A and C knew it. It therefore was part of a *conscious* memory in all three personalities, A, B and C. B had enjoyed the experience; A, owing to the peculiarity of her character, had suffered intense remorse and anguish to a morbid degree. She had, emotionally, almost torn herself to pieces over it, wearing sackcloth and ashes, and the memory of the experience awakened similar feelings. C, however, now remembering the experience, is sorry but philosophical. While regretting, she in no way suffers.

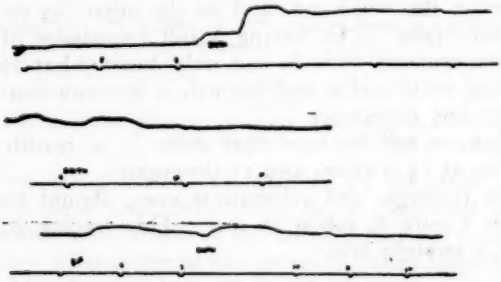


Fig. 4. Hypnosis c.

Fig. 5. Hypnosis a.

Fig. 6. Hypnosis b.

**Figs. 4, 5 and 6. Reactions from co-conscious memories in A and C and conscious memory in B for the same experience. A and C had amnesia for this experience (*Smith*).**

*** This was one of the few hiatuses in C's memory, and has since been filled.**

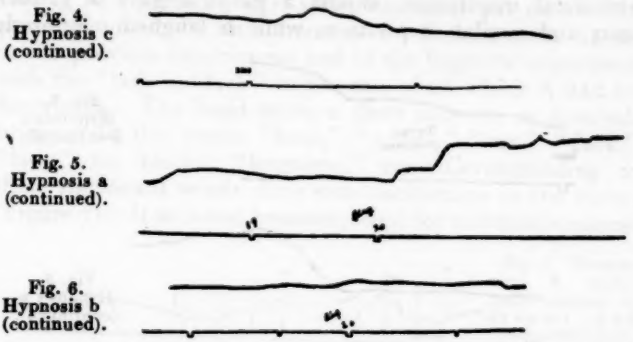


Fig. 4. Hypnosis c (continued).

Fig. 5. Hypnosis a (continued).

Fig. 6. Hypnosis b (continued).

**Figs. 4, 5 and 6, continued. Test word, *ring*. Conscious memory in all three hypnotic states for the same experience.**

Examining the tracings, of which we reproduce here only the portions corresponding to three stimuli (Figures 4, 5, and 6), we find rises corresponding to both these words. (The remainder of the tracing, corresponding to the indifferent words, showed nothing remarkable.) With "Smith" the greatest disturbance occurred with the hypnotic state c, who had no knowledge whatsoever of the experience connected with the name. The reaction must have been, therefore, due to a *subconscious* memory (belonging to B).

With a, with whom the memory was also subconscious, there was a rise, but much less marked, and approximately the same as that obtained with b, with whom the memory was *conscious*. c, it should be said, was first tested, and therefore, the surprise element may have been a factor in the height of the curve obtained with this state; and yet this explanation will not hold good with the word "ring" which gave curves with each of the hypnotic states, *corresponding to the intensity of the feeling which each experienced* in remembering the episode. c, first tested, did not show the highest curve, but a, whose feelings were most intense, gave the highest, c the next, and b almost none at all. It also should be noted that when the word "ring" was pronounced, c gave a deep and apparently

emotional inspiration, almost a gasp; a gave a sudden start and similar inspiration, while b laughed. Similarly

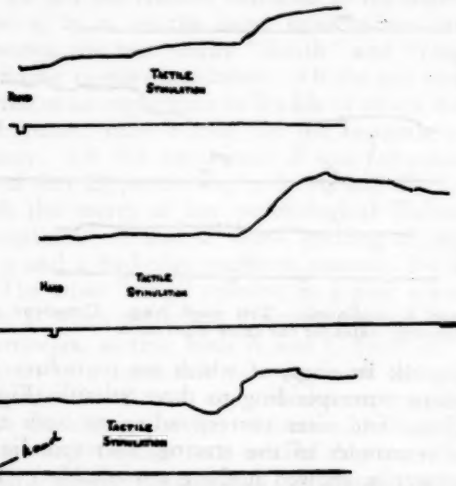



Fig. 4. Hypnosis c (continued).

Fig. 5. Hypnosis a (continued).

Fig. 6. Hypnosis b (continued).

Figs. 4, 5 and 6, continued. Reaction to tactile stimulation. a and c were anesthetic and therefore the stimulation was not consciously felt. With b it was consciously perceived.

with the word "Smith," c gave two deep inspirations of the same kind. Finally, after the last of the test words, each of the states, a, b and c, was subjected to a strong tactile stimulation that presumably included an emotional tone. The significance of this lay in the fact that a and c are absolutely anesthetic while b possesses complete preservation of sensation. Corresponding to this tactile stimulation there are marked risings in the curve in each of the anesthetic states as well as in b, showing that, *notwithstanding the anesthesia*, the tactile stimulation was co-consciously felt by a and c.

III. *To test co-conscious reactions in A during automatic writing.*

For this purpose, A was engaged in conversation in order to hold her conscious attention. While she was con-

versing in a perfectly alert state, her hand was directed to write automatically an account of the dreams made use of in the previous experiments and of the lorgnette experience with the "lady in black" in the car, of all which A had no knowledge. The hand wrote a short account, as directed, bringing in the words "boat," "waves," "cat," "dark," "lady" (in black), "lorgnette," etc. Corresponding to these significant words there were oscillations in the curve, (Figure 7). It was not, however, easy, for technical reasons,

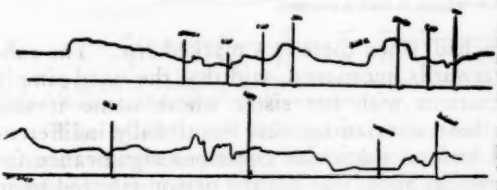


Fig. 7. Personality A. Automatic writing of dreams and "lorgnette" experience, for all which A had amnesia. Writing performed by co-conscious memories (B).

to record accurately the time of the occurrence of a co-conscious thought and connect it with the corresponding curve, as of course the thought arose before it was expressed in writing. The tracing was also much disturbed by the conscious emotional condition of A's mind, who waked to find herself with a stranger, introduced to aid in the experiment, in a situation of which she had no previous warning. All sorts of collateral thoughts were running through her mind, as C afterwards explained, owing to her embarrassing situation and fear of betrayal of her secret, etc. The tracing is probably also modified by artifacts. Nevertheless the curve is interesting and shows certain approximate relations with the co-conscious thoughts.

IV. *Experiments to test memories of personality B co-conscious with personality A who was the subject.*

Exp. 1. The test word was "Smith" and referred to an experience in B's life, already described, the memory of which was *now co-conscious in A*. The indifferent words were: — ashes, blue, song, read, Mr. Skillings, bright, Mr. Gill, forceful, *Smith*, good, tip-cart, copper, foot, lazy, shovel, run, towel, cold, kitchen, ring, carriage, modest,

floor, laugh, tongs, hot, hand. Examination of the curve (Figure 8)* shows a practically straight line until the word

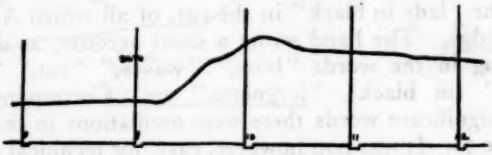


Fig. 8. Personality A. Reaction from co-conscious memory for episode (Smith) for which A had amnesia.

"Smith" is reached, when there is a marked rise. The subject, when afterwards questioned, said that the word simply aroused associations with her sister whose name it also was, but that these associations were emotionally indifferent and the word had no particular conscious significance for her. Of course her sister was not the person referred to in the episode in which B played a part. This rise, therefore, can be only interpreted as due to co-conscious associations.

Exp. 2. The test word was "darling." The subject, as before, was A. The indifferent words were: coal, red, song, reach, Myopia, rake, Mr. Gill, signify, *darling*, Norfolk, hoe, tin, street.

The word "darling" referred to a very comical experience in the life of B of which A had no knowledge. The memory of the episode was, therefore, co-conscious in A. It referred to a scene in which the word played a ridiculous

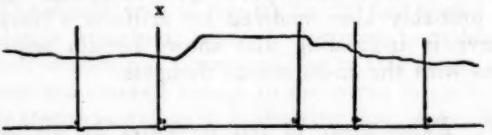



Fig. 9. Personality A. Reaction same as in Fig. 8 from co-conscious memory (darling = x).

part. The curve (Figure 9) shows a fairly straight line with a marked rise at "darling."

* Excepting when the reproduction of the whole seems necessary, we give in this tracing and in the others only those portions which have a direct bearing on the experiment. The remainder of the tracings may be assumed to be negative.

V. *To test conscious memories in A.*

The test words were "cats," "wall-papers," "hat," "black," interspersed as follows: [3]bad, [4]*cats*, [5]drink, [6]*wall-papers*, [7]good, [8]danger, [9]*hat*, [10]business, [11]walk, [12]hammer, [13]cry, [14]*black*, [15]round, [16]mouth.

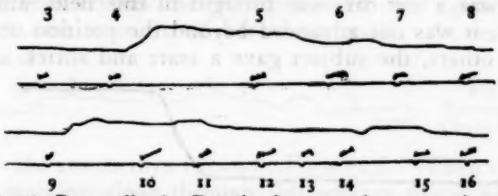



Fig. 10. Personality A. Reaction from conscious memories. "Cat"(4) upper tracing, and "hat" (9) lower tracing.

The word "cat" referred to an intense phobia for this animal which the subject has had ever since childhood. Its probable origin is in a childhood experience revealed through automatic writing. The subject, in none of her personalities or hypnotic states, has any recollection of the episode. The dislike of cats is so intense that the mere mention of the word produces a strong emotional effect and the presence of a cat has frequently produced an emotional shock. (See above account of dreams.)

The word "hat" is associated in her mind with several quarrels which she has had with her other self, B, over the kind of hat she should wear, B purchasing a light colored hat which A has as often exchanged for a black one. In fact, A is given to dressing in black which B dislikes, preferring light colors. Hence the word "black" was inserted.

The word "wall-papers" referred to similar quarrels over the selection of wall-papers for her house.

Figure 10 shows a marked rise in the curve at 4 (cats) and a distinct though not so high a rise at 9 (hat) and at 14 (black). The effect of "wall-papers" (6) was not especially marked.

VI. *To test perception in the peripheral field of vision. Subject: personality C.*

By a series of preliminary tests the point in the periphery of the field of vision was determined within which

objects could be perceived but not recognized. This having been determined, the following objects, with due precautions, were successively advanced from behind into this outer field. Although the subject perceived each, none was recognized excepting the last. The minute the last, which was a toy cat, was brought in this field, although, I think, it was not advanced beyond the position occupied by the others, the subject gave a start and shriek and ex-

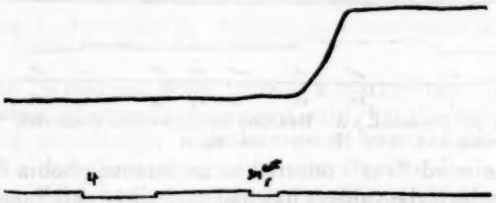


Fig. 11. Personality C. Peripheral vision of objects.

claimed "Cat!" The tracing (Figure 11) shows a straight line until "cat" is reached, when a sharp, abrupt curve is recorded. The light of the galvanometer travelled 18 centimeters.

The objects were: 1, matchbox; 2, pencil; 3, roll of paper; 4, watch; 5, toy cat. None of the first four objects were recognized visually by the patient, although she guessed the watch by hearing the tick which had inadvertently been forgotten. She could not describe in any respect any one of the other three objects.

When, however, the patient was hypnotized and put in the state b, the state which claims to be co-conscious, she was able to describe with minute accuracy each object, claiming that *she had seen them by peripheral vision, although the waking consciousness had not.*

VII. *Conscious reactions during "crystal visions." Subject: personality A.*

The subject was made to look into a crystal and reproduce a so-called "crystal vision" which, by suggestion, was made to take the form of the dream of the cañon, recounted above. As she looked into the crystal she recited what she saw, the dream unfolding itself like a panorama before

her eyes. She saw herself walking through this cañon exactly as she had dreamt it. The details exactly reproduced the dream. Whilst the vision unfolded itself, a tracing was taken.

While describing the vision, the subject, as is usually the case with crystal visions, experienced over again all the thoughts and emotions of her vision itself. At one place

Fig. 12. Personality A. Crystal vision.

she saw the stones turn to cats (x, Figure 12). Then she saw herself walking alone through this solitary place, sad and depressed by her helpless situation.

The tracing before "cats," not being remarkable, is omitted. The rise at "cats" was maintained by a succession of emotional states producing oscillations in the tracing. In the absence of a stenographer it was impossible to take down the recital verbatim, nor was it possible, for technical reasons, as in automatic writing, to connect the curves accurately with the ideas as they were unfolded.

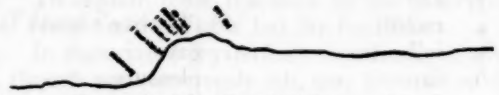


Fig. 13. Personality A. Crystal vision.

Another tracing taken during a crystal vision is represented in Figure 13. In this vision she saw the representation of a previous actual episode in her life occurring during the interment of her mother in the cemetery, and also *during a trance state* (*supposed to be a faint*) *into which she fell at the time.* She had very little or no conscious recollection of this episode owing to her having been in this abnormal condition, and yet she saw in detail everything that occurred in the trance. The correctness of the vision has been verified. The tracing shows the rise in the curve where she saw the scene in the cemetery. At this point she turned her head away from the crystal and kept exclaiming: "I can't look! I can't look!" etc.

VIII. *Word associations in the co-conscious.*

An attempt was made to test the reactions to word associations in the *co-conscious* as distinct from conscious associations. For this purpose, A's attention was engaged in conversation and the hand was made to write automatically. By the well known process of abstraction words were given to the co-conscious by whispering and the hand was directed to write the words associated in the co-conscious. By this method the subject does not *consciously* hear the words, but they are heard co-consciously. The test words used were those used before, viz: "Smith," "ring," "lorgnette," "darling."

There was some difficulty in carrying out the experiment as the co-conscious (B) rebelled after the first three words and refused to disclose its thoughts. It finally consented, however, to write a word in response, though that word might not be the first thought of.

| *Test word* | *Co-conscious associated word* |
|---|---|
| 1. sleep | dreams |
| 2. fruit | apples |
| 3. bad | +[1] |
| 4. mouth | ("I shan't speak"); teeth |
| 5. jolly | gay |
| 6. fun | pleasure |
| 7. Smith | lie[2] |
| 8. bed | rest |
| 9. pretty | lovely |
| 10. danger | ("I can't think") |
| 11. ring | Lowell[2] |
| 12. business | work |
| 13. dead | buried |
| 14. lorgnette | woman in black[2] |
| 15. cry | weep |
| 16. upstairs | attic |
| 17. darling | pencil[2] |
| 18. blood | cut |
| 19. offer | horrid man[2] |

[1] This mark was made by B because unwilling to disclose the name of a certain person.

[2] These words disclose episodic associations with the test words and represented associated thoughts, or judgments of the original experiences, viz., "bad," "Smith," etc.

The tracing, made under the same conditions as Figure 7 (page 124), showed general irregular oscillations due to conscious perturbation, as well as to the co-conscious word reactions and possible artifacts. As these cannot be distinguished from one another the tracing is omitted here.

The word-responses in this experiment are particularly interesting as bearing on the psychological interpretation of subconscious processes. It is difficult to explain such word reactions through pure physiological processes.

*Conclusions.*

1. In certain pathological conditions, active subconscious processes, i.e. memories of some kind which do not enter into the conscious life of the individual, may exist.

2. Memories of concious experiences which the subject can not consciously recall, i.e. for which he has amnesia, may be conserved and give rise to the same galvanic reactions which are obtained from conscious emotional states.

3. The reactions are compatible with and, so far, confirmatory of the theory that these subconscious processes are psychical (co-conscious).

4. To explain these reactions by the theory of physiological reactions is possible but far fetched.

5. In dissociated (hysterical) anesthesia, tactile stimulation, though not consciously felt, may give rise to the same reaction as when consciously perceived.

6. Objects not consciously perceived by peripheral vision may be co-consciously perceived.

# ABSTRACTS

**NOCTURNAL PARALYSIS.** *By Isador H. Coriat.* **Boston Medical and Surgical Journal, Vol. CLVII, No. 2, July 11, 1907.**

THIS is a study of an interesting case, showing certain pathological manifestations of sleep. The condition was first described by Weir Mitchell and Féré and called by them nocturnal paralysis. In the half-waking and half-sleeping (hypnagogic) state, there may arise a generalized motor paralysis, a phenomenon which is more or less protracted and which disappears as full awakening is established. This may occur as a transitory symptom in normal individuals, but when prolonged and frequently repeated, it can be considered as having assumed a pathological aspect. In the observation reported here, the attacks always occurred when the patient was in the hypnagogic state and were characterized by complete motor paralysis of all the limbs and an inability to move the eyes. After a period varying from two to five minutes she would cry out for aid, but until such aid was given there was total inability to move. She was unable to state how long the attacks would last if aid were not given. Psycho-analytic methods showed that the symptom-complex began about three months after the death of the patient's child, who died suddenly and under peculiarly distressing circumstances. It is of interest to note, that the position assumed by the patient in her nocturnal paralytic attacks was identical with the position taken by her child at the time of its sudden death and furthermore, the worst attacks always seemed on Monday, the day of the week on which the child died. The condition is interpreted as analogous to the temporary general palsy that is sometimes observed in patients during and after being awakened from a deep hypnosis and also as a hypnagogic motor repetition of a strong emotional episode. In other words we are dealing with a recurrent mental state whose chief manifestations are in the motor mechanism. As the condition was a purely functional one, waking suggestion applied by means of a fictitious magnet (tuning fork) affected a recovery in a short time.

MORTON PRINCE.

**ON THE BEHAVIOR OF THE PSYCHO-GALVANIC PHENOMENON IN ASSOCIATION EXPERIMENTS (UEBER DAS VERHALTEN DES PSYCHOGALVANISCHEN PHANOMENS BEIM ASSOZIATIONS EXPERIMENT; DIAGNOSTISCHE ASSOZIATIONSSTUDIEN. XI BEITRAGE).**
*By L. Binswanger. Journal fur Psychologie und Neurologie.* Band X, 1908.

THE work is a continuation of Jung's association studies and was done under his supervision at the Clinic in Zurich. The galvanometer has already been used in this connection by Jung and the apparatus and methods used were described by him in a former number of this Journal (Vol. 1, page 247), but this is the first exhaustive study made of the galvanometer and associations.

That various stimuli caused variations in the electrical resistance of the body as shown by the galvanometer has been known for a long time, but until recently no detailed systematic study of the variations has been made.

There are three different methods of investigating psychic processes with the galvanometer:

*a* The application of unpolarizable electrodes to unsymmetrical parts of the body used by Tarchanoff and Sticker.

*b* The use of electrodes of different potentials as zinc and carbon as done by Sommer and Furstenau.

*c* The use of electrodes of the same material and conduction of an electric current through the test person as done by R. Vigouroux, Féré, A. Vigouroux, E. H. Müller and Veraguth. The latter is the method employed in this work.

Binswanger used twenty-three persons as test-persons and has divided them for convenience into four groups; educated males and females and uneducated males and females. The reactions were analyzed by Jung's method and the deflections of the galvanometer were used to aid in the analysis.

The physiological and physical basis of the psycho-galvanic phenomenon is yet unknown. It is probable that the sweat-glands play a great rôle in all three methods. Although changes in the sweat-glands occur in all experiments it is not known whether they are absolutely necessary for the appearance of the galvanic phenomenon nor is it known whether we measure the same physiological changes with all three methods.

In regard to the physical changes it can be said that the promptness and exactness which is seen in the relation between the galvanic phenomenon and the psychic processes does not depend on a gross physical or chemical process. And above all it is not a question of processes which once excited continue on their way independent of psychical processes but rather such processes whose course can be continually controlled, aided or inhibited by a central organ. Changes in contact in the electrodes can offer no real explanation for the appearance of the galvanic phenomenon since it appears when water contact is used. Nevertheless involuntary pressure on the electrodes can, in a large degree, change the amplitude of the excursion. Deep inspirations, in general, act as psychological stimuli, i.e., through the accompanying feeling tone and not directly through the vaso-motor changes.

Binswanger has seen only affective processes, in Bleuler's sense, produce the galvanic phenomenon. In purely intellectual work as well as in perceptions not accompanied by a clear feeling tone there was no change in the electrical resistance. Complex-reactions (Jung) in the majority of cases cause a great deviation, reactions not accompanied by a feeling-tone, on the contrary, cause only a slight reaction. The typical complex curve consists in a large deflection with a rather slow return broken by short deflections. Exceptions to this normal are frequent. The tendency of the complex curve to *fall* is opposite to that which is found in the normal association curve which tends always to rise. Pictures similar to the falling leg of the complex-curves are seen in:

*a* Strong affects independent of the experiments.
*b* Active transfer of the attention from the experiment.
*c* External diversion.

Several observations allow the following conclusions; an existing complex, a strong affect or a strong concentration of the attention on something else than the experiment, inhibits the psychic elaboration of a given stimulation which remains poor in associations and feeling. From the lack of new affects there results a lack of new innervations and consequently there is a diminution of the galvanometric deflection. That the curve sinks gradually is explained by the fact that the acute affect, diminishes gradually and the intellectual inhibition called forth by the affect remains a long time.

Granting that when there is a sinking of the galvanometric curve there is an increase in the electrical resistance of the body, and when there is a rise there is a decrease, the observations would show that whenever there is an increase in the innervation whether by the application of sensory and psychical stimuli, by increased emotivity or by sudden tension of the attention, the resistance decreases, and whenever there is an inhibition or decrease of innervation there is an increase in the resistance, as in sleep, rest and in purely intellectual work.

Increase in the reaction time without a corresponding increase in the galvanometric deflection can occur;

*a* In purely intellectual perplexity, as indistinct perception of the stimulus, repetition of the same, or when unaccustomed words are used as stimuli.

*b* More often under the influence of perseveration.

When a complex perseveres the time may be lengthened but the deflection decreased. An explanation for this is found in the differences in the two values. The reaction time shows the *intensity* of the opposition between the perseverating feeling tone and the reaction which has just been called forth. The galvanometric deflection, on the contrary, shows the *result* of this opposition; in other words, the degree of attention which the new reaction has received. When the perseverating feeling tone is very strong the reaction time is very long, but the deflection is small because the reaction receives only a little attention and consequently only a slight feeling tone.

Increase in the deflection without a corresponding increase in the reaction time can be explained on purely linguistical grounds; the complex which is shown by the increased deflection cannot cause a lengthening of the reaction time if the test-person has a ready-made association at hand, although the emotional inhibition called out by such a complex is very hard to trace.

Klang associations in general, show large deflections when they are caused by a complex found in the reaction and a short deflection when they are caused by perseveration from a former complex. In the first case a deep-seated connection between the Klang associations may be found, in the latter case no such relations can be discovered. A Klang association with a large deflection refers to a deep-seated cause which often lies in the sub-conscious and must be revealed by psycho-analysis.

Complexes which are suppressed from the conscious seem to be able to act on the galvanometer.

The difference between the probable mean and the arithmetical mean of the deflection is a more certain criterion for the emotivity of a test-person than the difference between both means of the reaction time. In the latter, intellectual and linguistical factors play a rôle while in the galvanometric deflections only affective psychic processes are concerned.

In all four groups of test-persons, educated and uneducated men and women, the mean of the galvanometric deflections which correspond to long reaction times is greater than the mean of the collective deflections. Long reaction times, as a general thing, in all four groups correspond to the long galvanometric deflections. In all four groups the amplitude of the deflections increase with the number of the complexes.

Only the view which concludes from the characteristics of the complex that a feeling toned perception is present can explain these observations.

The work is full of interesting facts and shows that the galvanometer can be made to be of great assistance in psychoanalysis and render it much less difficult than it is at present.

CHARLES RICKSHER

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## BOOKS RECEIVED (continued)

LA PSYCOTHERAPIE DANS SES DIFFERENTS MODES. *Communication presentee an Congres par le Docteur A. W. Van Renterghem, d'Amsterdam. Congres International de Psychiatrie, de Neurologie, de Psychalogie et d'Assistance des Alienes, tenu a Amsterdam du 2 au 7 Septembre*, 1907. *pp.* 184. *F. van Rossen, Amsterdam.*

HYPNOTISM, OR SUGGESTION AND PSYCHOTHERAPY. *A Study of the Psychological, Psycho-Physiological and Therapeutic Aspects of Hypnotism. By August Forel, M. D. Dr. Phil. (H. C.) Et Jur (H. C.), Chigny, Switzerland. Formerly Professor of Psychiatry and Director of the Provincial Lunatic Asylum, Zurich. Translated from the Fifth German Edition by H. W. Armit, M. R. C. S., L. R. C. P. American Edition Revised and Corrected. pp. xii,* 323. *New York. Rebman Company.*

NURSING THE INSANE. *By Clara Barrus, M. D. Woman Assistant Physician in the Middletown State Homeopathic Hospital, Middletown, N. Y. Price* $2.00 *net. pp. x,* 409. *New York. The Macmillan Company.*

# REVIEWS

PSYCHOLOGY OF DEMENTIA PRAECOX. *By C. G. Jung*, 1907, pp. 179

THIS valuable study is the result of three years' clinical work on dementia præcox and is an attempt to give a logical explanation of the behavior and utterances in this disease, which formerly were looked upon as strange and at random. It is certainly a healthy reaction from the vague auto-intoxication theories and the barren results of pathological anatomy. In no other disease, outside of hysteria, have purely psychological investigations yielded data of so much importance. Studies along these lines have laid bare the essential mental undercurrents, a claim which cannot be made for purely pathological studies, although the latter possess great value in certain directions. The poverty of the results and the contradictory nature of the work in the pathology of dementia praecox, has previously been pointed out by me (*American Journal of Psychology*, April, 1905).

This recent monograph by Jung, submits to a searching analysis the essential psychological features of dementia præcox, sets forth the results of original work on the disease along the line of his well-known association studies and finally presents a review of previous psychopathological theories, such as the narrowing of the field of consciousness (Vogt), the theory of intrapsychic incoördination (Stransky), and of the dissociation of mental activity (Gross). The most striking new feature of the work is the attempt to trace the origin of individual symptoms, rather than to look upon these as strange, inexplicable behavior, the result of the lack of judgment and the primary apathy of the disease. Many of Jung's theories were however, antedated by Evenson and Stransky. Evenson found a close analogy between some of the prominent symptoms of dementia præcox, such as negativism, stereotypy, peculiar attitudes, etc., and the reactions of a normal person who has become preoccupied by one thought. He offered the suggestion that the essential features in both the preoccupied individual and in the katatonic are due to a narrowing of consciousness around a central content, and furthermore that there is a close analogy between hypnotic sleep and katatonic stupor. Stransky believes

that the symptoms of dementia præcox are due to what he terms an "intrapsychic incoördination" or a lack of inner unity between the understanding and the will. Careful analyses of the mental attitude of many of our patients have shown a peculiar blocking of thought, and a dissociation of the inner mechanism for will and action. Why in one case of mental dissociation there arises an hysterical complex and in another the symptoms of dementia præcox furnishes a valuable field for study. This important point Jung has attempted to answer. His success can only be judged when we have accumulated further material that has been analyzed along the lines indicated by him. Within the limits of a review only the barest outlines of his theory can be given.

In hysteria the emotional activity has not ceased, but is merely suppressed, while in dementia præcox the opposite holds true; that is, the emotions are inhibited and destroyed, hence the striking emotional apathy. In both diseases, the essential mental undercurrents may be laid bare by studying the associations to a series of test words and taking the reaction time, thus forming what Jung calls "complex-indicators," indicating that the test word is closely related to some hidden complex. Many of the random replies in both hysteria and dementia præcox are due to a disorder of the mechanism of association. By a natural transition Jung then passes to the important point of the influence of the emotional thought-complex in the association of ideas. Here he introduces his well-known association studies that have proved so valuable in bringing to the surface hidden emotional undercurrents, whether these be voluntarily suppressed or involuntarily dissociated. He believes in the frequent symbolic expression of these hidden complexes, a symbolism which is best seen in dreams. In fact there is a striking analogy between the mechanism of dreams and the actions of a dementia-præcox patient. In both there is a distortion of thought and normal healthy activity, a kind of maladjustment to the s oundings. When the underlying complexes control the e re mental life we have dementia præcox, when they merely le en the amount of mental energy at the disposal of the patient, w have hysteria. Thus there exists a close relationship betw en dementia præcox and hysteria, especially in the various manifestations of the hidden complexes. This relationship is

best seen in the strange anomalies of character, the general features of the mental dissociation and the narrowing of the field of consciousness, symptoms which are common to the two diseases.

I. H. CORIAT

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LA PSYCHOTHERAPIE DANS SES DIFFERENTS MODES. *By A. W. Van Renterghem*, Amsterdam, 1907, pp 184

ACCORDING to the author of this interesting little monograph, the psychological treatment of disease can be grouped into three different classes: *First*, psychotherapeutics proper, in which we console and encourage the patient, arouse in him the hope of a cure and attempt to remove from his mind his anxieties and morbid ideas. *Second*, psychic and motor re-education. Here we appeal to the intelligence of the patient, explain and analyze his particular disease to him, eliminate popular medical fallacies from his mind, modify his general mental attitude and in addition train certain muscles or muscular groups along normal coördinated lines. *Third*, direct suggestion, in which we attack the symptoms directly and implant in the mind the psychic image of cure.

The author then passes to a detailed discussion of hypnosis and replies to the various criticisms which condemn hypnotic suggestion. He does not agree with Dejerine and Dubois in substituting persuasion for suggestion. As the result of his own long experience he reaffirms the absolute innocuousness and freedom from danger of hypnotic suggestion in the hands of properly trained and properly qualified individuals. In many of the neuroses, hypnosis is not only more effective than persuasion, but its use actually lessens the period of treatment. This is a point of importance as many nervous patients are liable to become easily discouraged during a long course of treatment. In hysteria, neurasthenia, melancholia, obsessions and hypochondriacal states, insomnia, phobias, etc. — treatment by suggestion is far more effective than treatment by persuasion. The author isolates his patient amid quiet and soothing surroundings and treats each patient individually contrary to Wetterstrand's practice. In spite of his criticism of

persuasion, he frequently combines it with suggestion, thus making the treatment more effective. Frequently he gives the patient the same suggestions before hypnosis (waking suggestions or psychotherapeutic conversations) as during the hypnotic state. He believes in prolonged hypnosis., for hours or sometimes days, a procedure which to us appears quite unnecessary and useless. Physiological procedures in the treatment of the psychoneuroses receive but scant mention. This gives to the monograph a very one-sided attitude.

The greater part of the monograph is occupied with abstracts of his cases — thirty-one in all. They appear to have been carefully selected, for in all recovery took place. The cases were treated both by hypnosis and psychic re-education and comprise not only the functional psychoneuroses, but even such distinctly organic disorders as trigeminal neuralgia and malarial fever. Analgesia by hypnotic suggestion was successfully employed in several cases, the operations ranging from tooth extraction to laparotomy.

From the standpoint of the purely clinical aspects of psychotherapy, this monograph is one of the most interesting that has come to our notice. In many of the chronic functional neuroses, however, the author places too strong a stress on suggestion and not sufficient on psychic re-education. To us this appears one of the strongest defects of an otherwise valuable monograph, for it is just in these chronic neuroses that psychic re-education furnishes the best results.

I. H. CORIAT

## BOOKS RECEIVED

THE RIDDLE OF PERSONALITY, *by H. Addington Bruce. pp. xiii, 247. 8 vo. $1.50 net. New York. Moffatt, Yard & Company.*

A MIND THAT FOUND ITSELF. *An Autobiography. By Clifford Whittingham Beers. Cloth. pp. viii, 363. Longmans, Green & Co. New York.*

THE ANIMAL MIND, *a Text Book of Comparative Psychology. By Margaret Floy Washburn, Ph. D., Associate Professor of Philosophy in Vassar College. The Animal Behavior Series. Volume II. pp. x, 333. Net, $1.60. New York. The Macmillan Co.*

THE PSYCHOLOGY AND PEDAGOGY OF READING, *with a review of the history of reading and writing and of methods, texts and hygiene in reading. By Edmund Burke Huey, A. M., Ph. D., Professor of Psychology and Education in the Western University of Pennsylvania. Cloth. pp. xvi, 469. Price $1.40 net. New York. The Macmillan Company.*